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BETTER FRUIT

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SPECIMENS OF NORTHWESTERN APPLES

BETTER FRUIT PUBLISHING COMPANY, PUBLISHERS, HOOD RIVER, OREGON

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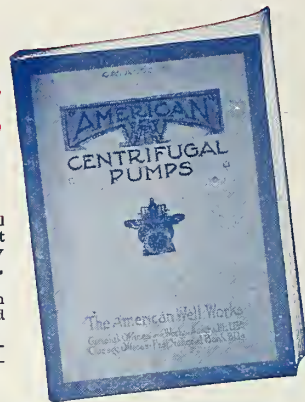
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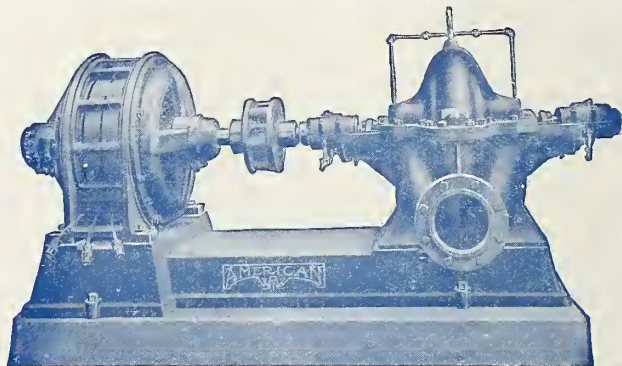
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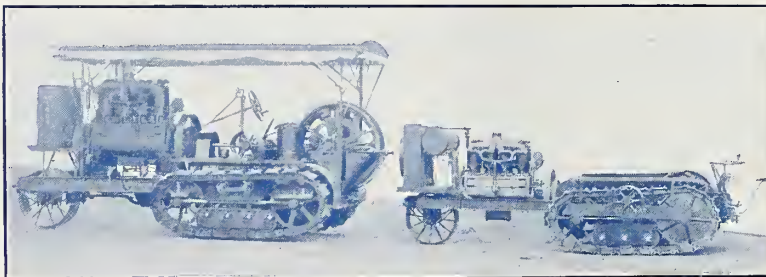
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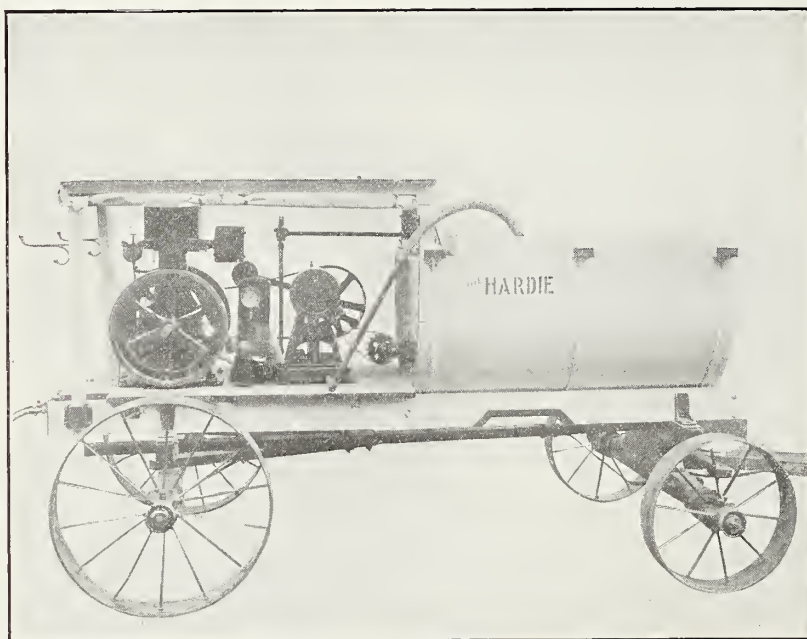
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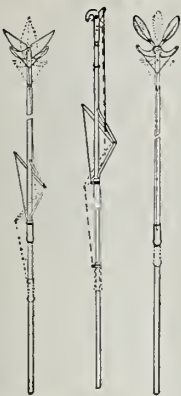
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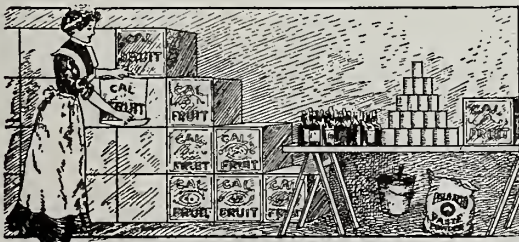
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BETTER FRUIT

AN ILLUSTRATED MAGAZINE PUBLISHED MONTHLY IN THE INTEREST OF MODERN, PROGRESSIVE FRUIT GROWING AND MARKETING

Fighting San Jose Scale and Other Insects

By Benjamin W. Douglass, Fowler, Indiana

TALKING with one of the exhibitors at the Indiana Apple Show I asked him if he had sprayed his orchard for the San Jose scale yet this fall. He replied in the most confident way that he did not need to spray for the scale because he did not have any in his orchard. Glancing over the fruit he had on exhibit I picked up a fine Pewaukee apple and in the calyx end found a number of scales closely grouped together. I wonder how many other orchardists are in the same condition of blissful ignorance? And I wish that I could quote to every one of them the old nursery rhyme, "Heavy, heavy hangs over thy head."

Like most of our other orchard pests, the scale insects have reached a position of economic importance only during the past few years, and if there had been a rigid inspection law twenty-five or thirty years ago the problem of the control of scale insects would be one to cause the orchardist no loss of sleep. About thirty years ago the San Jose scale was first identified at San Jose, California, by Professor Comstock, who found it on nursery stock at that point. The origin of the insect has since been traced with a fair degree of accuracy and it seems certain that the first scales of this species reached our shores from Northern China. From the one locality in California this "yellow peril" was shipped to a nursery in New Jersey, where it became established probably late in the eighties. Several nurseries located at Little Silver, New Jersey, were probably the first to send the scale into the Middle West. It soon became established in many nurseries, and these in turn distributed the pest to the planters all over the country. Orchards began to die, and after it was too late the horticultural public awakened to the fact that another enemy was present and that a vigorous fight would be needed if the fruitgrowers were not to give up in sheer discouragement.

After the neglected orchards had demonstrated the fact that the San Jose scale was fatal if not given prompt attention the fruitgrowers began to use systematic methods in the control of this new pest. Much experimenting was done with various washes. All manner of oil sprays were used and some of them were effective in killing the insects. Not all of them were fatal to the trees. The ultimate conclusion, however, is that any spray containing oil of any sort is to be looked upon with suspicion. Mixtures of carbolic acid, soap, whale oil, lye, and so forth, were also used in the early stages of

Features of this Issue

FIGHTING SCALE INSECTS

FIVE ARTICLES ON
WINTER CONTROL OF ORCHARD PESTS
BY W. H. VOLCK

STRAWBERRY GROWING IN
THE KOOTENAY DISTRICT OF BRITISH
COLUMBIA

CRANBERRY CULTURE ON THE
PACIFIC COAST
(Continued from last issue)

ORCHARD HEATING TO PREVENT
FROST INJURY
(Continued from last issue)

the scale control work, but none of them gave the uniformly good results that were obtained by the use of a solution of lime, sulphur and salt. This solution was formerly widely used in California as a dip for sheep, and it is understood that the California stockmen obtained the formula from the

ranchers of Australia. It is interesting to note that the chief remedy for the San Jose scale came to us from a far country and, like the insect which it controls, it was introduced unintentionally.

In its present form the lime-sulphur solution is somewhat different from the first preparations that were used. In the home-made solution the proportions of lime and sulphur have been changed and the salt has been left out altogether. The following formula is the one now in general use in many states and has been tried long enough to be of known value: Lime 50 pounds, sulphur 50 pounds, water 150 gallons. The lime must be of good quality and must be unslaked, although the new process, or hydrated lime, is quite as satisfactory as the stone lime. In any event it should be free from sand. The sulphur is what is known as flower sulphur or flowers of sulphur. Ordinary "rock sulphur" would answer the purpose, but it is difficult to get it in solution with lime. The lime should be added to the water, which should be hot, if not actually boiling, at the start. The slaking of the lime will cause the water to boil vigorously and the sulphur, previously mixed to a paste, should be added. Allow the solution to boil for one hour, when it is ready to use without further dilution.

A concentrated form of lime and sulphur solution is to be had from various manufacturers of spraying materials. This commercial preparation is a slightly different solution, chemically, from that which is obtained in the home-made article. It does the same work, however, and there are many advantages in buying the manufactured solution. In the first place it is a clear solution and does not injure the pumps and nozzles as the home-made solution does. By its use valuable time is saved during the spraying season and a decidedly messy job is avoided. While the commercial preparations cost a trifle more, this additional cost is saved in time and wear and tear on the spraying machinery. The results obtained by the use of the commercial article are in no way different from those obtained through the use of the home-made solution. I have heard a few reports to the effect that the results were not so good where the solution was bought, but I feel sure that some factor other than the quality of the material was the cause of the failure in every case. I have used both forms of the lime and sulphur and I cannot see any difference in results



Putnam Scale, enlarged about five diameters

when they are used under like conditions.

The solution should be sprayed on the infested trees so as to completely cover the trees from the ground to the top of the smallest twig. Thoroughness is the keynote of success with the spray pump, regardless of the season of the year or the object of the spraying. In spraying for the control of scale insects, however, the work must be exceeding well done. The tree must be sprayed from all sides, and when the job is finished the tree should be just as wet as though it had been soured in a great tub of the solution. To do such thorough work will necessitate the loss of some solution, but it is far better to let a part of the material drip to the ground than to run the risk of having the work half done. If the spraying is done during a time when the wind is strong it may be impossible to spray more than one side of the tree at a time. In such a case the spraying must be repeated when the wind changes. It is better to select a quiet day when there is but little wind.



School Children Gathering the Winter Nests of the Brown Tail in New England

Winter spraying may be done at any time when the solution does not freeze on the trees, but must never be done when the trees are wet. The tree surfaces must be dry or the results will be a failure. This is due to the fact that the water on the surface of the bark serves to dilute the spray solution when it goes on the tree. This diluting sometimes amounts to as much as 100 per cent, so that the effect on the scale insects is the same as though the solution was used only half as strong as our experience teaches us is necessary.

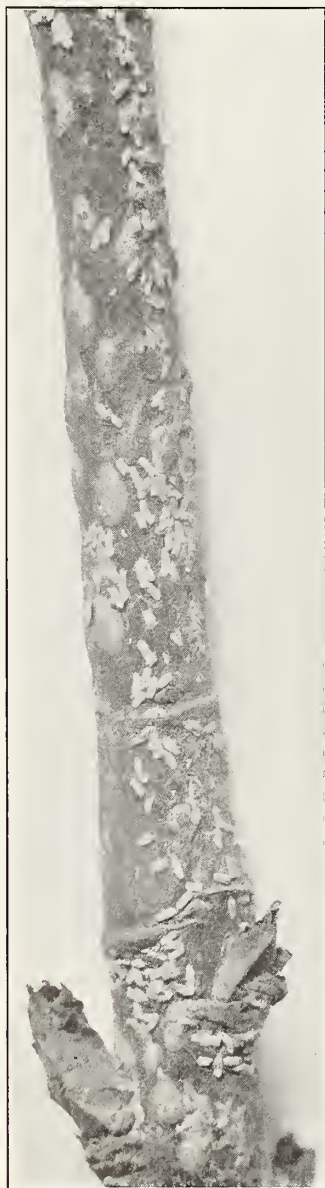
There has been considerable talk as to the advisability of pruning a badly infested tree before spraying. An extensive experience in the control of the San Jose scale and other scale insects leads me to believe that the matter of pruning prior to spraying is not one on which it is safe to lay down a definite rule. Conditions vary so much that a rule that works in one situation would be totally wrong in another. I know of some cases where the pruning should be done at the surface of the ground—like the man who advised cutting off the dog's tail just behind the ears. In other cases I would not trim a tree at all before spraying. It generally sifts down to a matter of good, common sense, and unless the orchardist is well supplied with this quality he will fail anyhow. I might say, however, that in a case where the tree was inclined to develop a high head with many small twigs that I would cut out the top and shorten in the smaller branches. In very severe cases the tree may be dehorned before spraying, but I doubt if this really ever pays. I have tried it in a number of cases and unless some expert pruner is able to watch the new growth closely the results are almost invariably poor.

As to the best time to spray, so far as the spring or fall seasons are concerned, it seems to me that the answer is one that would suggest itself to any thoughtful worker. Spray in the fall just as soon as the leaves are off. The

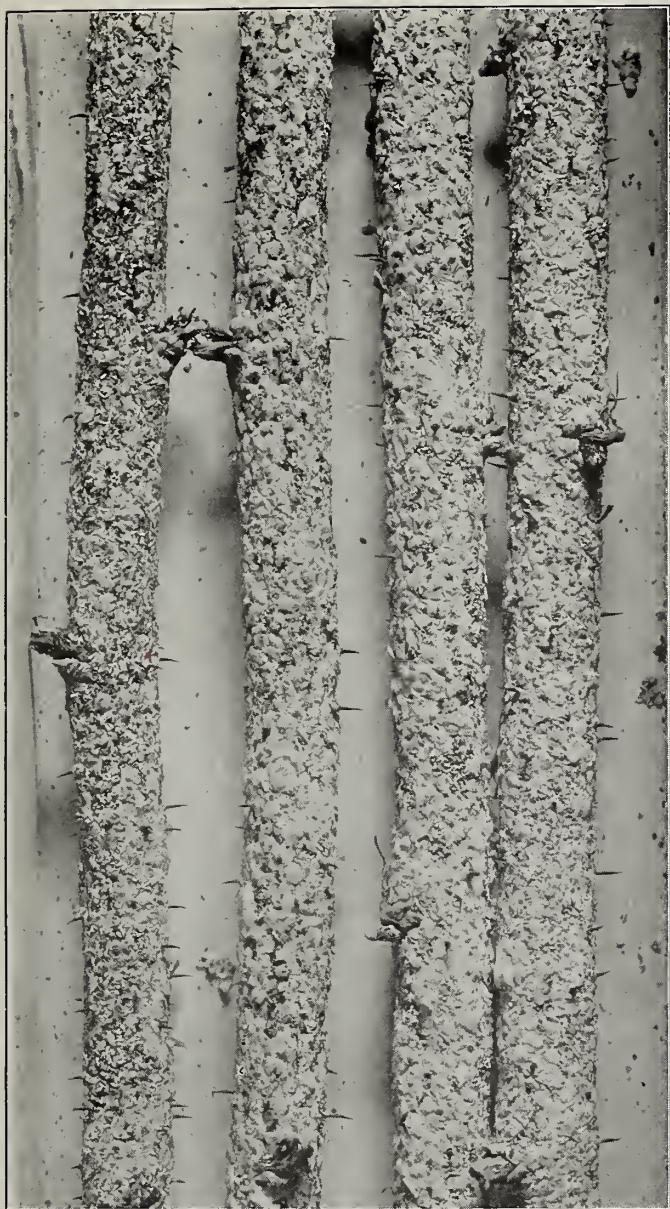
ground at this time is firmer and it is much easier to get around in the orchard; farm work is not so pressing as in early spring, and the best of all the reasons, the scales are killed promptly and possible winter injury by them is prevented. It is ordinarily stated that the scale insects pass the winter in a dormant stage, hence could not injure the tree during the cold season. In a measure this is true, but during mild winters I have found active young of the San Jose scale in mid-winter as far north as Indianapolis, showing that they were breeding, and necessarily feeding, at this season.

In certain sections of the West spraying for the control of scale insects has been largely replaced by the use of large fumigating tents. These tents are placed over the trees to be treated and a charge of hydrocyanic acid gas is generated in the tent. This violently poisonous gas kills all of the scales that may happen to be on any part of the tree. Of course, such treatment is far more thorough than any spraying could be, as the gas will penetrate the smallest cracks that would perhaps escape penetration by a solution. The process is open to the objection that it costs considerably more than spraying and the tents of a size necessary for a full-grown apple tree are very unwieldy to handle. It is not likely that the process will ever become popular in the East where large trees have to be treated, because of the fact that spraying will kill a majority of the scales and the cost is but a fraction of that required for fumigation.

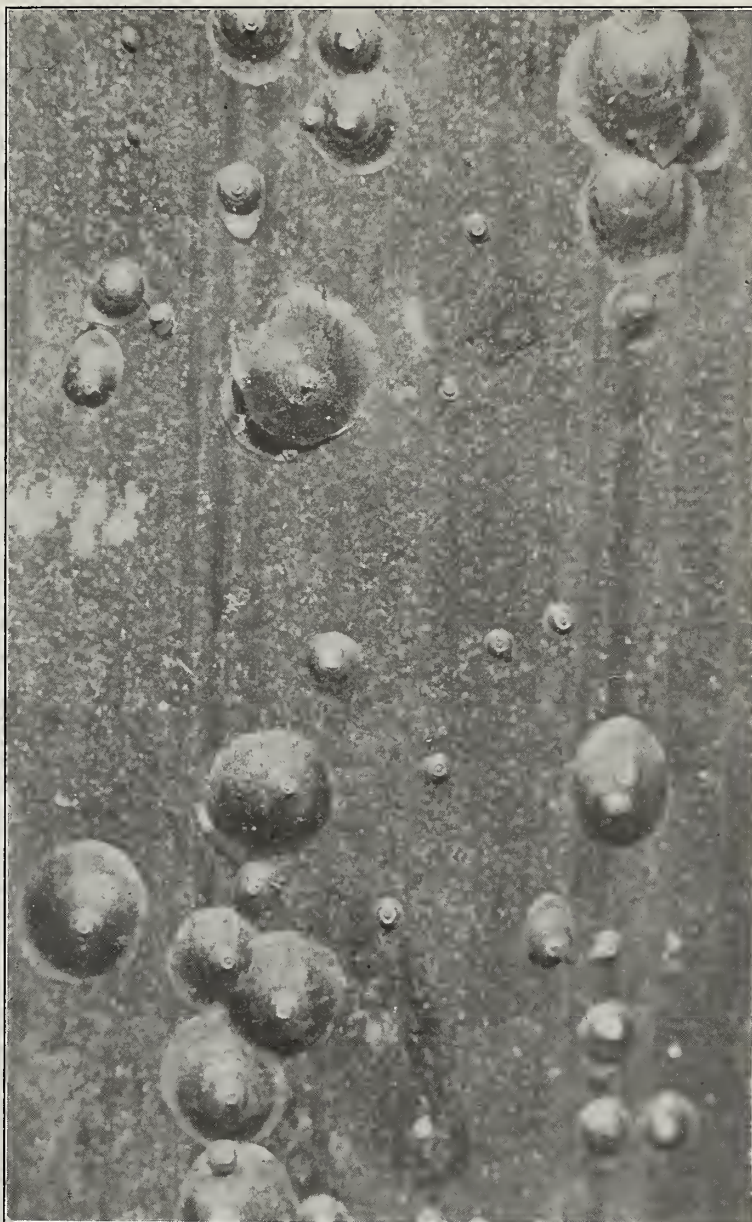
The only place where fumigation has a part in the work of the Eastern horticulturist is in the treatment of nursery stock. If there is a suspicion of San Jose scale or other scale on the stock it should be fumigated before being planted. Many states require that all of the nursery stock sold shall be fumigated before it leaves the grounds of the grower. If this work is properly done it cannot possibly result in any harm to the stock that is treated. The



Male and Female Scurfy Scale



Rose Scale on Blackberry Canes. Can be controlled by spraying



San José Scale, magnified ten diameters

work is ordinarily performed in a tight house, built for the purpose. Many types of houses are used for this work, but that which has given the most satisfactory results is one made of concrete. The house is framed up with rough boards and the frame or mould is filled with the cement mixture and allowed to set. This gives a house that is practically a monolith (a single piece of stone). Such a house is not only gas tight (as it should be), but it is free from the expense of annual repairs. On a wooden house the doors and windows must be attended to each year if the house is to remain tight. The high window in the back of the house should be close to the roof. The gas that is used is very light and it would be entirely possible for a pocket of gas to exist in the space above a ventilator window placed too low.

The amount of material used in one of these houses varies with the size of the house. For each 100 cubic feet of cubic space the following quantities of chemicals are used: Potassium cyanide, 95 per cent or better, one ounce; sul-

phuric acid, two ounces; water, four ounces. The cyanide is placed in a paper bag and is added to the liquid the last thing before closing the door. The man in charge of the work must learn that the gas which is developed is very deadly, and when the mixture is once made the operator must get out of the way quick. This gas has resulted in several deaths in the hands of careless workmen.

In the lands where the San Jose scale is native it is controlled by certain species of lady beetles. There has been some attempt to introduce these beetles into America, but all attempts have failed so far as practical results are concerned. In Florida certain species of fungous diseases are used to combat the San Jose and other scales, but so far attempts to grow these fungi in the Northern States have failed. About a year ago one of my assistants found a parasitic fungus growing on San Jose scale at Seymour, Indiana. This form was similar to one of the kinds used in Florida, and we were able to propagate it and have distributed it to many

parts of the state. It is still too early to judge of the possible results, but this one adventure with fungous parasites promises to make a most interesting story for a future issue.

All that I have said so far is intended to apply with especial emphasis to the San Jose scale, but there are many other species that will yield to exactly the same treatment. Among these are the cherry scale, Putnam scale, grape scale and English walnut scale. All of these are members of the same general group to which the San Jose scale belongs, and in a superficial way they all look alike. Any scale that does not pass the winter in the egg stage may be handled just as has been indicated for the San Jose scale.

The scurfy and oyster-shell scales are common and sometimes destructive pests. The latter is especially injurious in apple orchards. Either of these scales is more difficult to control than is the San Jose because of the fact that the insect passes the winter in the egg stage under the body of the old female. In this way the form is doubly pro-

tested; first, by the fact that it is in the egg stage, and second, by the heavy scale plate that acts as a secure cover to the eggs. Any insecticide must first penetrate the protecting layer of the scale and then destroy the somewhat resistant eggs. The oil sprays have given better results with the scales of this class than have the lime-sulphur preparations, but owing to the great danger of injury to the trees by the use of oil it seems advisable to continue the use of the sulphur preparations. If the spraying is repeated there is a greater chance of the solution taking effect than if a single application is depended upon.

In some cases the oyster-shell scale can best be handled by watching for the young scales when they appear in the spring and spraying at that time. This is after the young leaves have started out and it is difficult to spray without some injury to the foliage, but it is undoubtedly easier to kill the scales than in the winter time. This scale is particularly bad on certain kinds of shrubbery, notably on the lilac. In such situations it should be handled by the spring treatment men-

tioned above. Winter fumigation will not kill the oyster-shell or scurfy scales because of the fact that they are at that time in the egg stage. Consequently any nursery stock should be very carefully examined, and if the scales are found the stock should be burned at once. When nursery stock is infested with either of these scales there is no treatment that will render it safe to plant.

One of the most common scales on small fruit plants is the rose scale. This sometimes does great damage to blackberry and to red and black raspberry plants. The canes are sometimes crusted over with scales. Nursery stock may be made perfectly safe by fumigation, and the plants in the field may be sprayed with lime and sulphur in the winter time. The scale covering is very thin and it is not hard to get solution in contact with the body of the insect proper, consequently the scale is readily controlled.

An important item in the control of any scale insect is to see that no neglected plants or trees remain in the immediate neighborhood to harbor the

scales from one season to the next. The fact that many wild trees harbor the San Jose scale in the woods makes it impossible to ever attempt the complete extinction of this form. The careful orchardist, however, will see to it that no neglected haw trees or wild crabapples remain close to his orchard. The common osage hedge is another plant that often is the means of concealing the presence of destructive scales. If you have an old hedge on your farm you would better cut it down and build a wire fence. There are many other "bugs" that find a shelter in this ancient form of boundary marker and no good farmer can afford to let the hedge remain. If it is old it may yield enough good posts to build a good fence. Regardless of what scale insect you may be fighting or how you may be fighting it, there is one thing that must not be lost sight of—your work must be thorough. If you are not prepared to do the work thoroughly and with the greatest care you had better cut down the orchard or sell the farm and let someone else tackle the job for you.

Caterpillars, Codling Moth, Aphids

By W. H. Volck, Horticultural Commissioner Santa Cruz County, Watsonville, California

IN the Monterey Bay district apples are attacked by a number of leaf and fruit-eating insects. Most of these make their appearance along with the first leaves and blossoms. The various caterpillars frequently begin hatching from the eggs as the buds are swelling and are ready to commence work on the first green that appears. Blossoms are frequently injured before they have opened and the young fruit marred while forming. These foliage and flower-devouring insects are all controllable with arsenicals provided the spraying is properly done in due time. Owing to the very early attacks of tussock caterpillars, canker worms and leaf folders the first spraying should not be delayed until the blossoms have all fallen, but applied while the trees are in bloom. The period from full bloom to the time when two-thirds of the blossoms have fallen appears to be the most practical timing. Spraying with good arsenicals will cause no injury to the blossoms.

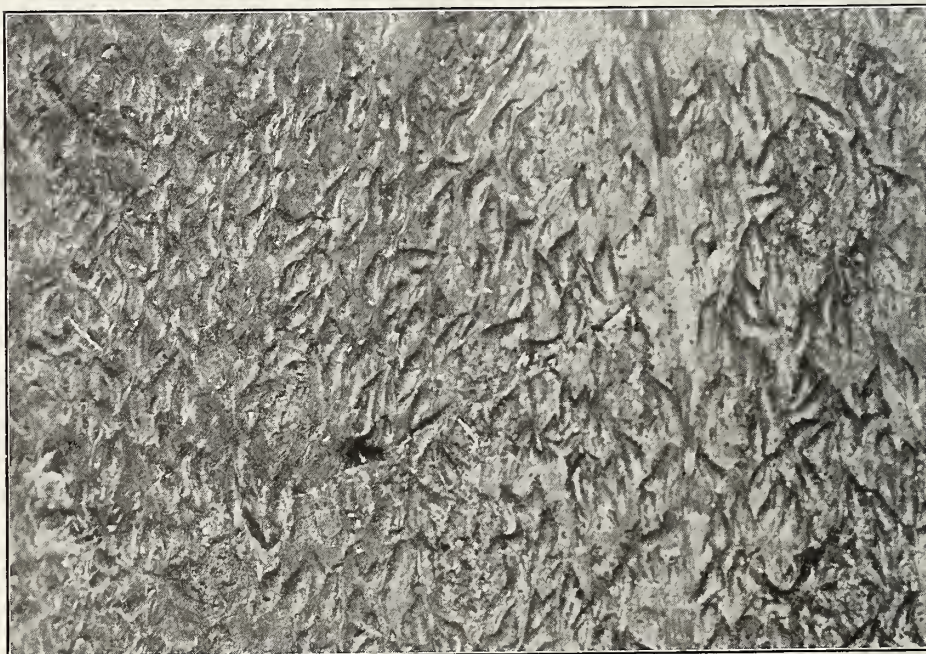
For this early application zinc arsenite has given the best results, both in the experimental plots and orchard demonstration work. This arsenical was first used in 1907, when a few acres were sprayed twice during the blooming period. No injury followed and the damage from tussock caterpillars was greatly reduced. The codling moth was also better controlled than in neighboring orchards sprayed with arsenate of lead only. No further use was made of zinc arsenite until 1910, when the first commercial material was put on the market. That year most of the spraying with zinc arsenite was rather too late to give the best results with the tussock caterpillar, but the great effi-

ciency of the new arsenical was well demonstrated by the quick killing of canker worms. Some arsenical injury also developed, for the foliage was too far developed to allow the safe use of so strong a poison. Notwithstanding these disadvantages those who used zinc arsenite were well pleased with the results.

In 1911 several growers used zinc arsenite during the blossoming period and obtained much improved control without injury or damage to the crop. During this season it was also demon-

strated that iron sulphide when used with zinc arsenite prevented foliage injury even when the zinc was used late in the season. By adding nicotine to any such combination the aphids may also be held in check. I consider that experimental and commercial spraying with zinc arsenite has now been followed a sufficient time to warrant the following general recommendations:

Formula for codling moth and caterpillar sprayings, also mildew: Zinc arsenite (dry basis) 6 pounds, iron sul-



Oyster Shell Scale



A Well Sprayed Orchard

phide (commercial) 6 pounds, "Black Leaf 40" 1 pound, water 200 gallons. Mix the zinc arsenite and iron sulphide into the water and add the "Black Leaf 40" last. Agitate continuously while spraying. The iron sulphide and "Black Leaf 40" may be omitted, but our experience justifies their use, the first to prevent any possible arsenical injury and to promote a better foliage growth and the second to control aphids.

Apply the first spraying when the trees are in bloom, full bloom to the time when two-thirds of the blossoms have fallen. The second spraying with the same material should be applied in ten days to two weeks after the first. In case no iron sulphide was used in the first spraying the second application should not contain zinc arsenite, but instead neutral arsenate of lead at the rate of 16 to 20 pounds to 200 gallons. This dosage is considerably greater than any before recommended and is made with a view of bringing the poison value near to that of zinc arsenite. However, the efficiency will not be as great even when an equal amount of arsenic is used in the form of lead arsenate as zinc arsenite. This is due to the fact that the arsenic in zinc arsenite is more soluble in the stomachs of insects than that in lead arsenate. The great merit of neutral arsenate of lead lies in the fact that it is absolutely harmless to foliage regardless of the quantity used and the timing of the application. The codling moth is well controlled with this arsenate, and where it is only to be combated it is not necessary to use the stronger and more dangerous arsenicals later than the blossoming period.

Acid lead arsenate contains more arsenic than neutral arsenate of lead and is more effective against insects, but also dangerous to foliage. In point of efficiency it stands about half way between zinc arsenite and neutral lead arsenate. Its foliage-injuring properties may be controlled in the same way

as the zinc compound, that is, by use with finely divided sulphur or iron sulphide. Formula: Acid or Pyro arsenate of lead 16 pounds, iron sulphide 6 pounds, "Black Leaf 40" 1 pound, water 200 gallons. Apply with the same precautions regarding timing as given for zinc arsenite.

No part of spraying procedure is so essential as thoroughness in application. The best materials may give very inferior results if poorly applied. It is no exaggeration to say that ninety per cent of the men handling spray rods do not know how to spray a tree. Nearly all of these men fail to reach the tops and also go over their work so hurriedly that it is quite impossible to get the full results. Such spraying is more expensive by far than a thorough job, even though the items of time and material may be double. In order to apply spray in such a manner as to insure the maximum efficiency it is necessary to

train the men to begin with the tops of the trees and hold the nozzles high in the air long enough to thoroughly wet these parts. Before this is accomplished much drip will have fallen down on the lower branches, which makes it possible to spray them quickly. The tree should be sprayed from all angles, up, down and sidewise, and when finishing the lower portions it is necessary to stand well back in order to catch the projecting tips. The matter of nozzles is quite important, for while thorough work can be done with various types some require more skill in handling than others. The most efficient nozzle is the one which will do the most work automatically. If nozzles are mounted at an angle of 45 degrees to the rod they can be directed upward, downward and sidewise by simply twisting the rod. With this type of nozzle it is as easy to spray up under the foliage as down. Also if the nozzle projects the spray a long distance and delivers a large volume there will be less danger of missing the tops or stinting material. One of the most efficient nozzles now on the market is known as the "Friend Angle Drive-Spray." This nozzle should be used with the largest size aperture (two sizes are furnished) and at a pressure of about 200 pounds. These nozzles throw a narrow cone of spray a considerable distance and are well adapted to spraying the tops of large trees. Light spray rods should be used and need not be more than ten feet long. Eight feet is sufficient in most cases. The aluminum rod has now been perfected, so there is little danger of breaking, and is much lighter than an iron pipe.

No leaks should be tolerated about a spray outfit; especially is this true of the connections about the nozzles and rods, as such leaks are very annoying to the men and greatly interfere with thorough work. It is not necessary for the men to become soaked with spray when properly fitted angle nozzles are used, for with this type of nozzle it is



A Power Outfit for Fighting the San José Scale

possible to spray against the wind without being in the drift of the spray. To do this the man can stand to one side and by turning the rod direct the spray straight at the tree and against the wind.

In most of the Pajaro Valley orchards the two sprayings already described will be sufficient to control the codling moth for the season, but an additional

spraying three to four weeks after the second application will make the result doubly sure. Also in the warmer hill sections where the worms are more numerous a spraying in June and another in August are advisable. Neutral arsenate of lead should be used in these later sprayings unless the regular mildew spraying program is being followed, in which case it is possible to

continue the use of zinc arsenite at reduced strengths.

Formula for late spraying: Neutral arsenate of lead 12 pounds, "Black Leaf 40" 2 pounds, water 200 gallons. The quantity of "Black Leaf 40" is doubled at this time because the woolly aphid is likely to be on the increase and is more difficult to kill than the green aphid.—Press Bulletin, No. 9, 1912.

Winter Control of Orchard Pests

By W. H. Volek, Entomologist, Watsonville, California

AS is indicated by the title this article discusses remedial measures, both spraying and otherwise, which may be profitably applied to dormant trees. The diseases and treatments are here presented under separate heads, but a short general discussion is included with the hope that it will render all the matter more clear. Winter spraying of apple, pear and peach trees has now become a well established practice, but is not yet so frequent or general as is necessary to obtain the best results. This spraying practice is the result of a considerable number of years of systematic research as well as the accidental discoveries of unscientific experimenters. Several tree diseases may be controlled by winter spraying, and some can only be reached at this period, still others are not affected by such treatment. Then it is of importance to the orchardist to understand just what may be accomplished with dormant trees in order that he may obtain the best results. Among those diseases controlled by treatment during the dormant period may be mentioned the San Jose scale, greasy scale, oyster shell scale, brown apricot scale, black scale and other scale insects. Moss, peach blight, pear blight, sappy bark disease and peach-leaf curl also belong in this list, and the tussock caterpillar and peach worm should be added. The diseases and insects partly controlled by winter spraying cannot be so closely defined, but green aphid, woolly aphid, red spider, apple scab and pear scab are most important. A list of pests not known to be in any way affected by winter treatment, spraying or otherwise, will include the codling moth, tent caterpillars, leaf-curling aphid and apple powdery mildew. The canker worms should be mentioned here, for although tangle-foot bands applied early in the fall and maintained in working condition until the blossoms drop in the spring will prevent trouble, yet as far as apples are concerned it is best to spray with arsenate of lead after the foliage appears.

In considering the treatment of the above enumerated pests the part played by natural forces in either augmenting or reducing the injury should be considered. Almost any of the parasites mentioned are capable, when the conditions are favorable to them, of inflicting serious injury. On the other hand, unfavorable conditions may render these same pests of no importance.

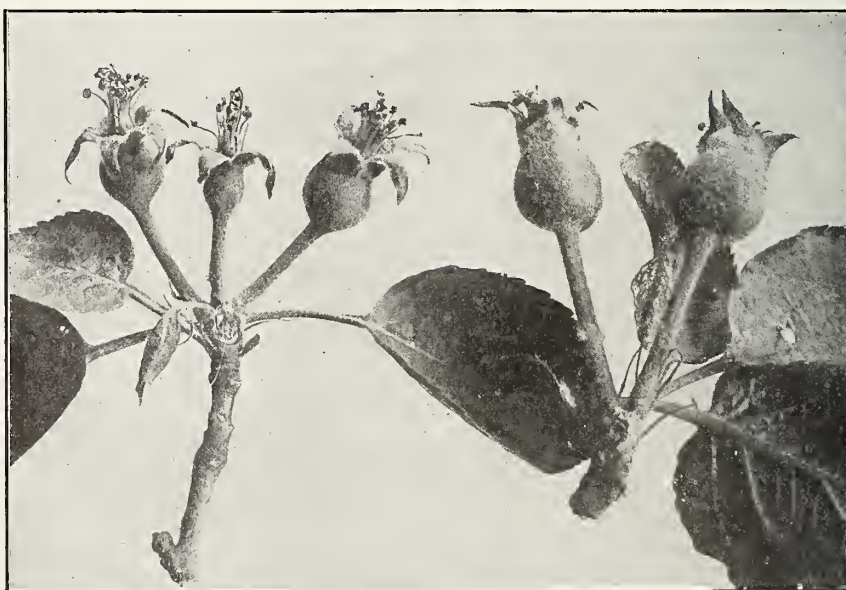
Usually climatic and other natural conditions bring about a partial control, with occasional seasons in which the pest in question becomes either especially destructive or almost disappears. Insect and fungous parasites of the insect enemies of cultivated plants often play a part quite as important as the weather conditions in determining the abundance of this class of pests. With fungous and bacterial diseases, however, climatic conditions are practically alone in determining abundance.

The fact that orchard pests are subject to great fluctuations in destructive power complicates the question of economic control by artificial means. The commercial value of control measures depends entirely upon the amount of injury prevented by the use of them, and may when applied unintelligently quite as frequently result in financial loss as gain. The ability to forecast the injury from any pest would unquestionably be of great value to orchardists, but unfortunately our knowledge of the determining conditions is not complete enough to enable us to do this with certainty. Frequently the orchardist attempts to make such forecasts, but he is often too prone to underestimate the damage which may result from the attacks of pests, and so lose what might have easily been saved. About the best advice which can be

given in this connection is to take those preliminary steps necessary to successful control and then apply further treatment as circumstances may require. To illustrate, spraying with lime-sulphur solution in the winter or early spring will greatly reduce the danger from apple scab, but if there is much rain during April and May an application of bordeaux should be given about the middle of the latter month.

Then as a certain amount of spraying is necessary as an insurance against possible injury from pests it is of great importance to the grower to apply a treatment with a wide range of usefulness. It should be remembered that fruit trees are subject to injury by both insects and fungi, and if it is possible to select a material which will do good work against both classes of parasites a decided economic advantage has been gained. The choice of a spray material is also governed by the effect on the tree regardless of the control of diseases. It is very essential that no damage should be done to the trees, especially when the probable injury from pests is unknown and may be nil. Also if any stimulating or invigorating effect can be obtained it will be a decided advantage.

Of all the spray materials now known the one that most nearly fulfills these requirements is the lime-sulphur



Apple Clusters showing, on the left, young fruit with calyx lobes spread and in right condition for spraying; on the right, apples with calyx lobes closed and too late for satisfactory spraying.

solution. This insecticide and fungicide has been used under a very wide range of conditions for a sufficient length of time to demonstrate its great value as a general as well as special treatment. So far as our present knowledge goes there is no danger of injury to dormant trees by the free use of lime-sulphur solution at practically any strength, and there is evidence that stimulation and invigoration may result. The lime-sulphur solution is decidedly the best spray material to use for general purposes and as an insurance measure against possible damage from insects and fungous diseases. Just how often trees should be sprayed in order to give the highest financial returns has not been definitely determined, but we feel quite safe in recommending an application every other year, and the annual use of lime-sulphur solution may yet be a practice quite as regular as plowing and pruning.

The lime-sulphur solution is a compound of lime and sulphur produced by boiling the two together in water. It was formerly known as "lime, sulphur and salt." The salt is now quite generally regarded as unnecessary. The compound can be prepared by the orchardist or purchased as a strong solution ready to dilute with water. The home-made and commercial solutions are of the same efficiency where an equal amount of sulphur in solution is contained in each. The question of which is preferable is largely a matter of cost. There is this difference, however, between the commercial and home-made solution as ordinarily prepared. When the solution is made on the farm it is usual to add much more lime than is required to cut the sulphur. This makes a mixture more difficult to handle on account of the excess lime present in the form of whitewash, and the grit that is contained in the lime. The excess lime also combines with the lime-sulphur solution, forming a compound which crystallizes and goes out of solution on cooling. This renders it necessary to use the home-made formulas while hot, which is another disadvantage. The excess lime which creates all the above mentioned difficulties may just as well be left out of the lime-sulphur solution formula. The following directions are calculated to enable anyone to prepare lime-sulphur solution in any desired quantity, and which will be the same as the commercial solution.

To make 200 gallons of spray of proper strength for the San Jose scale and other winter uses: Sulphur 66 pounds, lime 33 pounds, water (to prepare) 50 gallons. Place the water in boiling vat that will carry the quantity without danger of boiling over. Then, when fairly hot, add the lime, stirring to insure the formation of a smooth milk of lime. The sulphur should now be added and the mixture boiled moderately, but constantly, for forty-five minutes to an hour. If the water boils away very much more hot water should be added from time to time. During the boiling stir every few minutes by

raking over the bottom of the vat with a hoe. A very good practice in handling sulphur is to pass it through a sieve to break up the lumps and then moisten it with a small amount of water by kneading. Sulphur so treated mixes with the milk of lime better. When this formula has been boiled sufficiently it will be a very dark-colored and rather thin liquid with only a small amount of sulphur left undissolved. The solution is now ready for straining through burlap or cheese cloth. The undissolved sulphur can be returned to the vat to be worked up with the next batch. The strained solution should be diluted with water to make 200 gallons, and if extra lime is desired well strained milk of lime may be added along with the water. This extra lime should not be added until the spray is ready for use, as it will cause the sulphur-lime compound to crystallize out of solution. Salt can also be added to the prepared solution if desired, but all recent investigations have discredited this practice. The San Jose scale is as well killed when no salt is used, but some contend that the peach leaf-curl is better handled with salt.

Much has been said of late to discourage orchardists from making lime-sulphur solution. Among other things, it is claimed that the strength of the home-made solution varies greatly from batch to batch. Possibly there are cases of great carelessness where such variations have occurred. The old formulas are also quite cumbersome and may have led to such trouble. With the formula described above ordinary care should insure the variation in dissolved sulphur content between the best and poorest batches to be less than five per cent. It is not necessary to use the high-priced sublimed sulphur in making lime-sulphur solution. The lower priced powdered sulphurs on the market are all reasonably pure and make good lime-sulphur solution. The lime should be of the best quality and free as possible from grit, which cuts out pumps and nozzles.

As has already been stated, the commercial solution is as effective as the home-made preparation when the same amount of sulphur in solution is contained in each. The commercial solution differs from the old home-made formulas in that it contains much less lime, and from the formula given in this article in that it is free from grit and insoluble matter. The question of which is best to use is then a matter of comparative cost. In counting the cost all things should be considered, including the equipment of boiling vats, fuel, labor and last, but not least, the wear of the spray machinery due to grit in the home-made solution. The great demand for the commercial solution is a very positive answer in favor of the ready-made spray, and the retail price of nine to ten dollars per fifty-gallon barrel seems to have met with general approval. The standard strength of the commercial solution is now 33 to 34 degrees Baume. This concentration is practically as high as it can be made and should therefore be satisfactory to

the consumer. For winter spraying this material should not be used weaker than one gallon of the concentrated solution to nine gallons of water (1 to 9).

The effect of weather on lime-sulphur spray is a question on which there has been considerable difference of opinion. It is apparent that the deposit left by the lime-sulphur sprays is not appreciably washed off by rains, but this is not equivalent to saying that no change takes place. There are water soluble as well as insoluble ingredients in the spray deposit. It is also well known that sulphur is more active in warm sunshine than cool, cloudy weather. These deductions are in harmony with our experience, for we find the best results from lime-sulphur spraying when the application is followed by a week or ten days of warm sunshine.

Bordeaux is a combination of lime and bluestone (copper sulphate). The active or efficient portion of the spray is the copper it contains. The copper in the bordeaux mixture is in the form of a slowly soluble compound which is more or less dissolved by dews and rains. This dilute solution of copper is very poisonous to fungous parasites, but when rightly prepared and applied does not injure dormant plants. For these reasons the bordeaux mixture is the best general remedy for fungous diseases known. For winter use the bordeaux mixture should be prepared stronger than for summer applications. A good general formula would be: Bluestone 7 pounds, lime 6 pounds, water 50 gallons. First dissolve the bluestone. This is readily done by suspending the bluestone in a sack in a barrel of water. The barrel should be filled nearly full of water and the sack containing the bluestone suspended as near the surface as possible. In this way fifty pounds of bluestone can be dissolved in a barrel of water in a few hours. If enough barrels are at hand it is most convenient to dissolve just the amount required for a tank in each. The lime should be slaked in a small amount of water and then strained into the spray tank along with one-half to two-thirds of the water required for the tank. Now add the bluestone solution, stirring constantly. If a power outfit, start the agitator. When the mixture is complete add what water may be required to fill the tank.

Oil and Soap Sprays.—Mineral oils and some animal and vegetable oils are good contact insecticides for special purposes. This class of insecticides should not be used where the lime-sulphur solution will serve as well, because the fungicidal value is very slight, if any, and there is always danger of injuring the plants sprayed. In certain cases the insect in question is not killed by the lime-sulphur solution and an oil spray must be used. One of the best of these sprays for general purposes is the distillate lye mechanical mixture: Distillate oil (28 degrees Baume) 6 gallons, caustic soda 6 pounds, water 100 gallons. Place the materials in the tank of a power spray outfit provided with a rapid-revolving agitator.



Winter spraying in the apple orchard is taken as a precaution against the pests
Scene in Yakima Valley

Keep the agitator in constant motion while spraying and never use any of the spray that has been standing in the hose even for a few minutes. Blow this off for one or two minutes, or until you are sure that the mixture is coming fresh from the tank. These precautions are necessary in order to avoid injury from separated oil.

Oil Emulsions.—Distillate and other oils can be emulsified with soap so that a mixture with water can be made with only a small amount of agitation. These emulsions are suitable for use with hand pumps and are very convenient even with power outfits, but have the disadvantage of being more expensive than the mechanically-mixed oils. Distillate emulsion can be made by the orchardist, but much trouble is avoided by purchasing commercial emulsions and diluting so that the spray mixture will contain six per cent of distillate. Some emulsions will stand the use of lye, as with the mechanically-mixed oil, and some will not. Lye is not necessary unless it is desired to kill moss. The following formula given by Dudley Moulton should make good distillate emulsion: Hot water 12 gallons, whale-oil or fish-oil soap 30 pounds, distillate oil (28 degrees Baume) 20 gallons. The soap is first dissolved in a kettle of boiling water and then removed to the spray tank, where the oil is added. This should be agitated violently and then sprayed out under pressure of 125 to 150 pounds into other barrels. This stock solution contains about fifty-five per cent of oil. Dilute one part of the emulsion with eight and one-half parts of water to give a six per cent mixture.

Fish-oil soap may be made as follows: Water 6 gallons, lye 2 pounds, fish oil 1½ gallons. Place the water in a caldron, add the lye and then the

fish oil and boil slowly for about two hours. This will make about forty pounds of soap, or about a five-gallon mixture.

Soap solution: Common laundry soap ½ pound, water 1 gallon. Dissolve the soap by boiling; apply hot as it will jell on cooling. This spray is useful for all kinds of scale insects and is recommended where it is desired to spray a few small trees.

Time of Application of Winter Sprays.—The work on the peach blight in the Sacramento and San Joaquin Valleys has demonstrated the great efficiency of early winter spraying, at least for this disease. It is probable that early winter spraying will be as efficient for other diseases, if not more so, than the mid-winter treatment. In the early winter the San Jose scale is less dormant than in January and consequently more affected by adverse conditions. Some other pests and diseases are similarly influenced by the season, while in the case of the sappy bark disease (anthracnose) an early application of bordeaux or lime-sulphur is supposed to prevent the entrance of the fungus into the tissue of the bark, where once established it is beyond the reach of a spray treatment. The advisability of early spraying is much favored by the probable weather conditions met then as compared with mid-winter and spring. It is clearly better to spray before the ground has become miry; besides, even if it is possible to get on the land with a heavy outfit there may not be enough clear weather to allow spraying the whole orchard. From the above consideration it is recommended that the orchards be sprayed as soon as enough leaves have fallen to allow thorough work. This will be some time in November or the early part of Decem-

ber. Spraying for the peach blight and sappy bark disease should not be delayed later than December 15.

Late Spraying.—The period just as the buds are unfolding has also proved to be a very efficacious time for spraying for some diseases. The apple scab is a case in point. This disease is well controlled by the bordeaux mixture, and also by the lime-sulphur solution when applied just before the blossoms unfold. With regard to the efficiency of the lime-sulphur solution as a control of the apple and pear scab we are now perfectly certain. Lime-sulphur solution may be used on apples, pears and peaches at full winter strength up to the time of the opening of the first blossoms. The efficacious application of winter sprays is then distributed over quite a long period, with the best results obtained in the early fall and early spring.

Spraying Outfits.—Spray materials, however good, are useless unless thoroughly applied. The cost of spraying is also largely a matter of application, so the efficiency of the spray outfit is of considerable importance. When not too heavy to handle readily the power outfit is much superior to hand pumps because of its ability to deliver a large volume of spray at a constant high pressure (150 pounds). These outfits are also equipped to give much better agitation than is commonly obtained with hand pumps. The power outfits now in use are of several patterns, but modifications and improvements are constantly being made in order to better meet the requirements. This evolution is producing a standard type, the essential features of which are a square tank with a cover and a revolving agitator mounted on a shaft passing through the middle of the top and provided with a means of adjusting the speed or disconnecting, as desired. A pressure pump of durable and simple construction is connected with the tank by means of suction pipe or hose, and the whole is operated by a gasoline engine of from one and one-half to three horsepower. The exhaust of the pump is connected with the hose lines, usually two in number, but with an intervening air chamber and escape valve to regulate the pressure. These parts are all compactly assembled on an orchard truck or wagon. To carry the spray material from the pump to the nozzles a pressure hose about fifty feet long is used. The hose is attached to a small metal pipe from eight to twelve feet long, at the end of which the nozzles are mounted. This extension rod is necessary in order to reach the tops of the trees. The nozzles, usually two in number, are mounted on a Y at the end of the extension rod and are calculated to produce a voluminous, well-divided spray when operated at the proper pressure. The nozzles now in use are of two principal types, Bordeaux and Cyclone. The Bordeaux nozzles throw a fan-shaped spray that carries well and can readily be adjusted to various requirements.

Continued on page 48

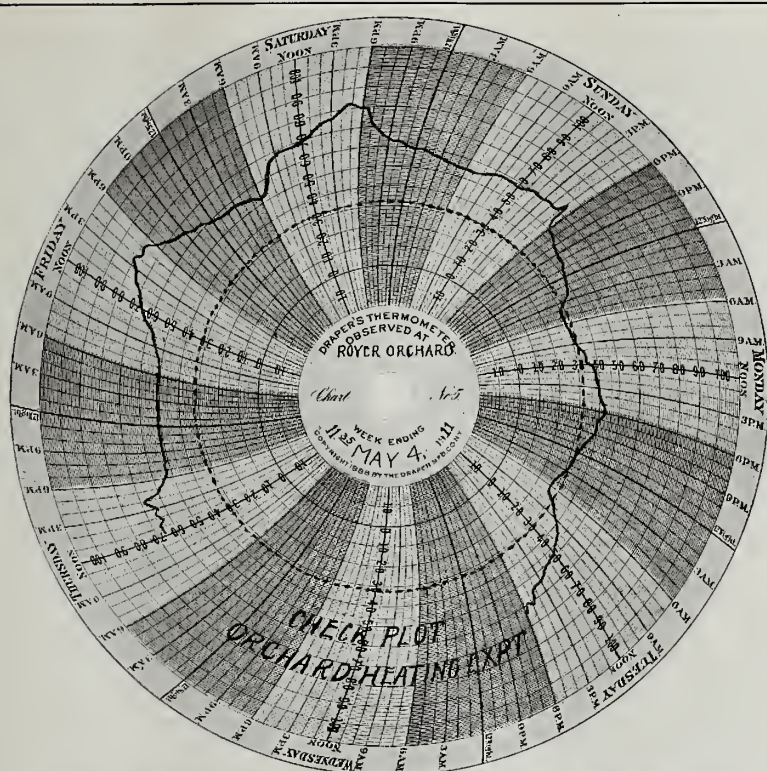


Figure 7—Self-Recorded Temperature Chart Made in Experiment Station Commercial Orchard.
The temperatures were recorded from the Thursday preceding to the Tuesday following the freeze of May 1 and 2, 1911.

the surrounding country and on an east slope. About 80 lard pail and Troutman six-quart heaters per acre were used, placed about eight feet from each tree in the alleys. The fires were lighted at 33° by the use of a gasoline can and torch made from a piece of corn cob and heavy wire. The lowest temperature outside of the heated area was 28°, while the lowest inside the heated area was 30½°, with an average rise of from 3° to 4°. The night was clear, with an estimated wind velocity of four miles per hour. During eight hours of heating it was estimated that 240 gallons of oil per acre was consumed. This would mean that the heaters were refilled twice during the night. Mr. White wrote that, owing to the small capacity of the heaters, the work was very difficult and required more men than was practicable, and that it would be much better to provide a larger capacity pot. The oil used was the same as that used at the station experiment orchard at Council Bluffs, having been purchased from the Standard Oil Company, Kansas City, Missouri. The blossoms were about two-thirds out at the time of the frost, and Mr. White states that he believes the June drop was not quite so heavy in the heated area, especially on Ben Davis. Mr. White gives the cost of his heaters at \$105, oil \$55 and storage \$26, he having used ordinary oil barrels to store the oil in. He estimates his labor at 15 days for one man and one team 4 days. He recommends 100 heaters per acre and states: "I believe heating practicable in Iowa if larger reservoir heaters are used. High winds make it difficult to protect the tree tops." Mr. White drew the oil from the tank car into barrels by means of pipe connections at the tank car and a long lead of one and one-quarter inch hose. These barrels were then rolled onto a flat wagon and hauled to the orchard. This method was found as

Experimental Orchard Heating in Iowa

Continued from last issue

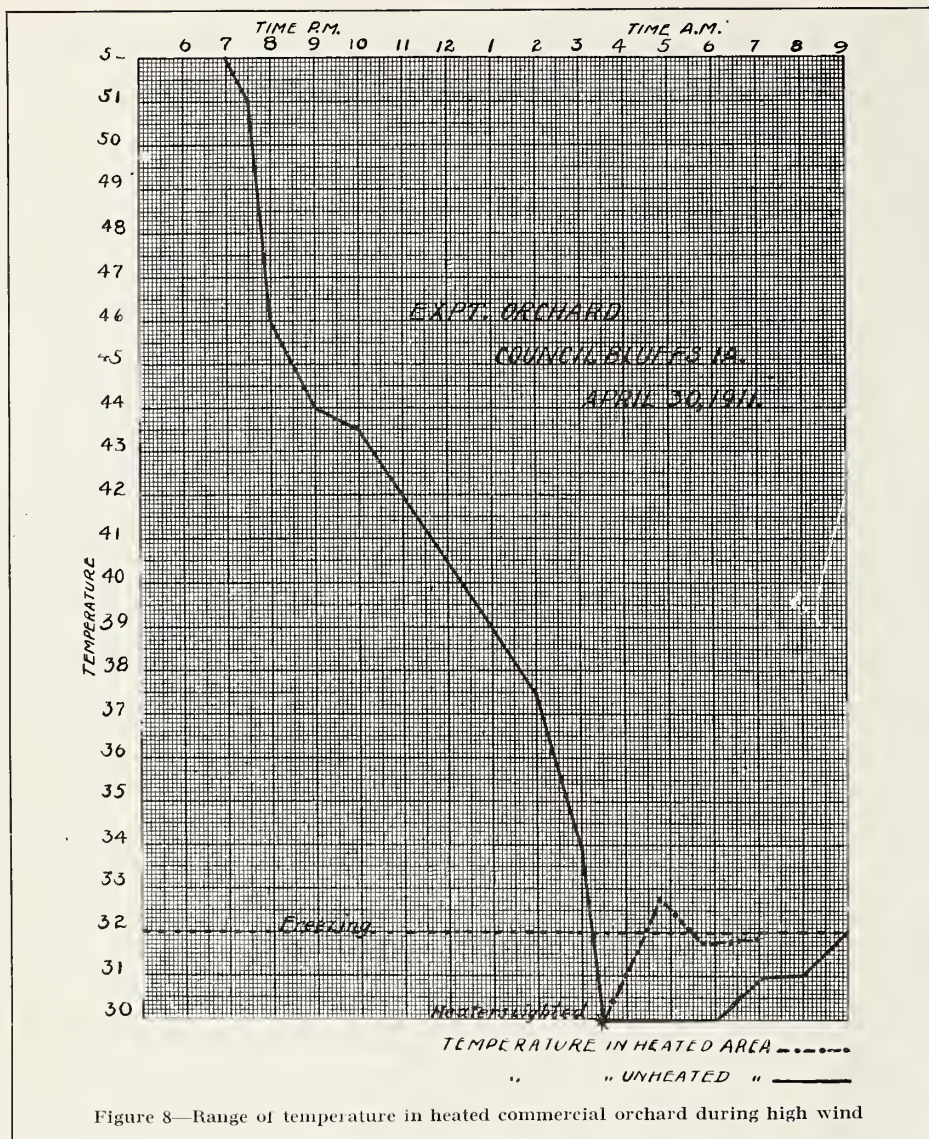
A. A. Simons, Hamburg, Iowa—Mr. Simons heated 15 acres of trees from 16 to 20 years of age, and set 28 feet apart each way. The orchard is located on all slopes and some of it on level ground, averaging somewhat lower than the surrounding country. The heaters were placed about 60 per acre and 28 feet apart each way, one pot about 12 feet from each tree. Mr. Simons started firing at 32° on the night of April 30, when a high wind was blowing, using a gasoline can and torch, which is not described. On the night of May 1, when it was comparatively clear and still, he fired at 30°. The lowest temperature inside was 34° and the highest 36°, an average rise in temperature of from 6° to 8°. On the nights of April 30 and May 1 the heaters were burned for about eight hours and consumed about 150 gallons per acre. From Mr. Simons' estimate it appears that the Hamilton heaters burned dry in the eight hours' firing, but on account of the heavy wind which blew on the night of April 30 it is not surprising that this amount of oil was consumed. The oil used was of 31 gravity, purchased from the Standard Oil Company. The blossoms were just ready to burst and no apparent injury was noted at the time the report was made. The cost of equipment is given as follows: Heaters \$360; oil 1.4 cent per gallon f.o.b. the refinery; no statement being given as to freight cost. The storage tank used by Mr. Simons is described elsewhere and holds 10,000 gallons, costing

about \$125. Mr. Simons states that he believes orchard heating is practicable under Iowa conditions and will place more pots per acre next year. In order to be prepared for high winds he recommends 60 to 75 heaters per acre, using the reservoir type.

S. K. White and W. S. Keeline, Council Bluffs, Iowa—About 8 acres of trees from 18 to 20 years old were heated, the trees averaging about 20 feet apart. This orchard is high as compared with



Figure 9—Snow-covered Ground Outside of Heated Area During Test. The line of demarcation between unheated and heated areas is clearly shown.



cheap as hauling in a tank wagon and then transferring the oil to barrels or storage tank. There is one difficulty in the use of barrels in that any oil left over will not keep as well as when stored in steel or cement tanks.

F. P. Spencer, Randolph, Iowa—Mr. Spencer heated about 15 acres of trees 18 years of age. The trees stand 33 feet apart each way. He placed four heaters per tree, but used only about 50 heaters per acre, these being placed about 30 feet apart. The orchard stands on a northeast and northwest slope, but is high as compared with the surrounding country. He fired his heaters at 32°, using gasoline with a torch made from a corn cob. The lowest temperature outside the heated area was 28°, while that inside the heated area was 32° to 36°, an average rise of from 4° to 5°. The night was clear, with practically no wind. The heaters were burned for five hours, consuming, estimated, 65 gallons of oil per acre. This was the common fuel oil put out by the Standard Oil Company. The blossoms were about ten per cent open and no injury resulted so far as was apparent. He estimates the cost of his equipment as follows: 50 heaters per acre \$10; oil 3½ cents per gallon, deliv-

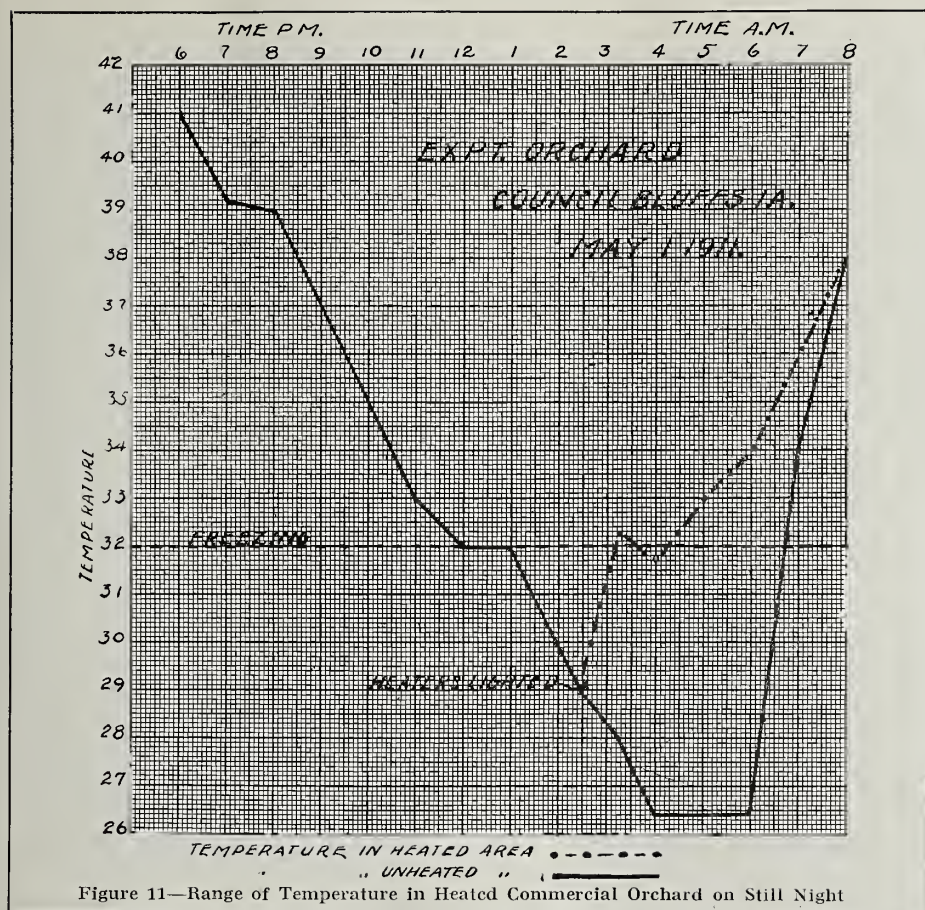
ered in the pots. No statement of labor or storage capacity is given. Mr. Spencer used a steel tank for storage. Mr. Spencer states "most emphatically" that he does not think that orchard heating can be successfully practiced with high winds.

C. E. Mincer, Hamburg, Iowa—Mr. Mincer heated 16 acres of trees 14 to 20 years of age, the trees standing 20 to 35 feet apart. This orchard is on a west slope, extending down to level ground which is located just at the foothills on the east side of the Missouri River Valley. Eighty heaters per acre were used and set from 20 to 30 feet apart each way, placing them between the trees in the tree row. He fired up at 28°, and reports that the lowest temperature outside the heated area was 25°, while inside the heated area the lowest was 27° and the highest 34°. The average rise in temperature was 6°. He reports that he fired on both April 30 and May 1, heating five hours on the night of April 30, which was windy, and 12 hours on the night of May 1, which was clear and still. He estimates that he used 80 gallons of oil every four hours, meaning that each pot burned one quart per hour. He states that the trees were in full bloom and that a difference in favor of the heated area was noted in the amount of drop. His estimate of cost is: For heaters 22½ cents each; no statement for the cost of oil or storage tank is given; his labor cost him \$30 this year. Mr. Mincer has a 16,000-gallon storage cistern, which was built in the spring of 1910. No statement is given as to the cost of this cistern. He states that orchard heating is very practicable under Iowa conditions and that part of the crop will be saved even with high winds. He recommends 100 heaters per acre.

Under Iowa conditions, and in view of the available data at hand, it is best to use more heaters per acre than have been recommended in the West. It has been said that the temperature could be kept above the danger point with as many or fewer heaters than are now used in the west, but owing to the fact that Iowa orchards are widely separated, so that heat from one will not help others, and that Iowa has cold waves accompanied by high winds, more heaters per acre should be provided. Of the smaller heaters it will be



Figure 10—Ground Bare of Snow Within Heated Area During Test. A 36-mile wind blew the snow into the north side of the heated area, and yet the effect of the heating was marked.



necessary to use from 80 to 120 per acre; probably 100 is a good average number to use. Of the larger pots 60 to 80 per acre should be used. It should be remembered that the smaller fires scattered over the orchards are much better than a few large fires. In using the large heaters it is not wise to reduce the number too low, even though the burning surface can be made much larger than on the smaller heaters. Moreover, in using a large number of the larger heaters, the amount of the flame per heater can be reduced, thus giving greater reservoir capacity and long-continued fire.

The type of heater to be used must be determined by each grower for himself. In a general way it may be said that the larger heaters will give best satisfaction, as they furnish a reservoir for the storing of oil for longer periods of firing. It is almost impossible, and at least impracticable, to try to refill the pots during the night. If the refilling equipment is not working well great loss is apt to result. A gallon of oil will burn only about four hours, and as Iowa frost periods are apt to be much longer than this, greater capacity is needed. Even though some heaters may burn a gallon of oil for a longer period than four hours, there must be a loss of heat, as it requires a certain amount of burning oil to raise the temperature a given amount. If a larger number of the smaller heaters are provided so that a part can be fired in the early part of the night and the remainder at successive periods, they will give as good satisfaction as the larger heat-

ers. With most heaters there is less heat given off as the oil burns low in the pot, and a reserve supply of heaters should be on hand to take care of this deficiency. In addition the temperature is usually lower just before sunrise than at any other period and the burning surface of the oil should be greater at this time than earlier.

For storing oil a cement cistern lined with asphaltum gives the best results. This is especially true if the cistern is located on a slope so that the oil may be handled by gravity from the tank wagon to the cistern and from the cistern into the distributing wagon. These oils are very difficult to handle by dip-

ping or pumping methods. However, the rotary pumps have given general satisfaction when the lighter oils have been used. The cistern walls should be six to eight inches thick to give the best results. The floor need not be so heavy, probably four inches thick being sufficient. The cement used should be composed of about one part cement to two or three parts of sand. If crushed rock can be used in mixing the concrete, one part of cement, two or three parts of sand and four or five parts of crushed rock will give good results. These walls should then be finished with cement plaster, thus giving a smoother surface. The whole inside should be painted with two or three coats of asphaltum paint. Paraffine has not given thorough satisfaction among some of the Middle Western growers. The roof of the cistern can be made of a reinforced cement slab. This slab will vary in thickness, according to the width of the cistern; but if it is not over eight feet wide a well reinforced slab five inches in thickness should be sufficient. Any local cement company can give definite instructions in regard to details.

A. A. Simons of Hamburg built a cement cistern 20 feet long, 7 feet wide and 10 feet deep, with 8-inch walls, 4-inch floor and a roof made of "Hy Rib reinforcing," plastered inside and out with concrete. The total cost of this cistern, including excavation, was about \$125. (To prevent cracking a cross wall might well be used.) Such a cistern would hold approximately 10,000 gallons. This storage capacity would be ample for an orchard of 20 acres, and in most seasons would supply even a larger orchard than this. C. E. Mincer of Hamburg describes his cistern as follows: "The cistern is rectangular in shape with rounded corners and bottom sloped to one corner where the outlet pipe is. The side walls were constructed first eight inches thick and reinforced all around with hog wire, a section of wall the height of the hog wire being put up a time. These sections were not allowed to dry before



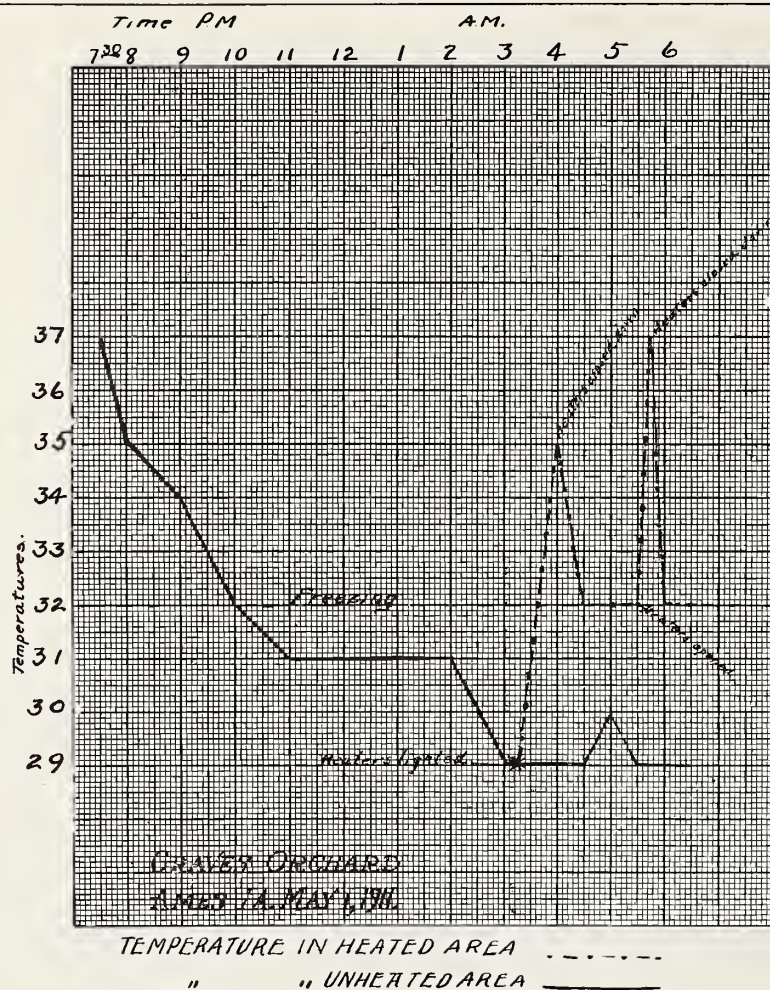


Figure 13—Range of Temperature in Heated Home Orchard

the upper section was put on, as we worked day and night until this was completed. Side walls being completed, we laid hog wire on floor and spread about three inches of slush concrete on this wire. Walls and floor and top were all constructed of slush concrete, one part cement to three parts sand. Before the floor was set we laid boards on it and removed the wall forms, pointed up all defects and gave it a coat of slush with brush, half cement and half sand. Top was covered with canvas and several oil stoves lighted, and in ten hours another coat was given of cement slush and sand. In six hours more a thorough coat of asphaltum paint was placed on walls and floor, followed by two more coats in twelve hours. A two and one-half inch pipe was used to carry it away from cistern. It was now filled to the top with fuel oil and covered with canvas, in which shape it remained for two months. "Hy Rib"—a metal lath furnished by the Trus Con Steel Company, Detroit, Michigan, was bent to arch and laid over the top of the cistern. A very light coat must first be applied and allowed to set thoroughly, and later any thickness desired may be added. A manhole was constructed in top of cover, allowing entering. A gauge left in the tank has shown no leakage since it was constructed. I would suggest that more time should

be taken in making such a cistern than we took."

At present the smudge oil put out by the various oil companies seems to be the cheapest for Iowa conditions. In securing prices it is well to secure them f.o.b. receiving station, as this will

avoid looking up freight rates. Most companies will quote f.o.b. refinery, however, unless otherwise requested. Oil can be purchased in tank car lots from one and one-half to three cents per gallon. In barrels it will cost four and one-half to six cents per gallon. The amount of oil necessary will depend upon the number of frosty nights and length of time that heating will be necessary. This will be hard to forecast, and sufficient oil should be provided to last through more than the ordinary number of frosty nights. Most seasons from one to three frosty nights are encountered. The frosty period usually occurs late in the night, after midnight, and lasts until sunrise. From three to five hours will usually cover this period. However, certain nights may occur when it will be necessary to keep the fires going from eight to ten hours, and others when perhaps only an hour's heating will be necessary. From three to six gallons of oil per heater should be provided. If there is good storage this oil will keep from year to year, so that what is not used may be kept over for the next season. The grower is much better prepared for emergency if the larger amount of oils is on hand. Oil is too cheap to allow shortage of supply to occur.

In the distribution of the oil wagons holding 300 to 400 gallons will be the best size. These should be sufficiently high so that good pressure can be obtained at the end of the hose used for filling the pots. The hose and fittings as described in the fore part of this article will give good satisfaction. A wagon for this purpose can be secured at from \$15 to \$20. If 10 acres or more are to be protected it will be well to provide two wagons; and as these can be used in transporting the oil from the tank car they will be found almost indispensable. It is very



Figure 14—The Three Kinds of Orchard Heaters Used in Tests

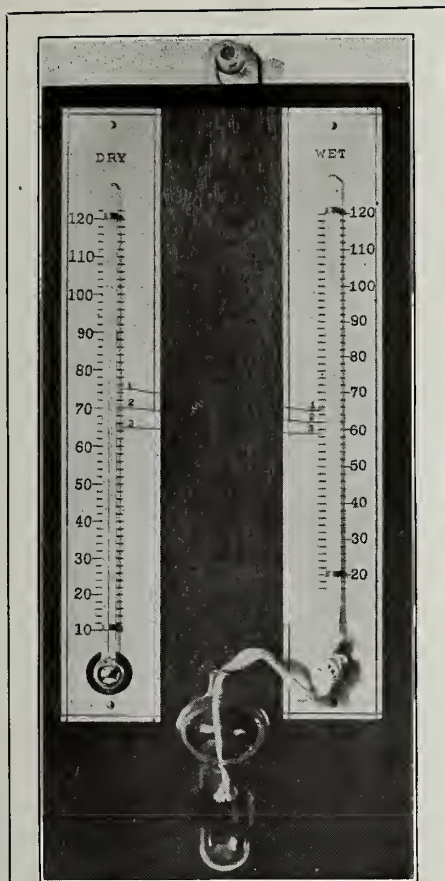


Figure 15—One Form of Psychrometer.
This instrument has proved of much
value in predicting frosts.

important that these wagons be perfectly tight and that pipe connections be tight, with good solid valves. Handling the oil is a dirty job at best, and unless all leakages are prevented it becomes doubly disagreeable.

Accurate thermometers should be provided. At least one high-grade tested thermometer should be available to test less expensive ones by. Faulty instruments are sure to cause loss, as firing may be begun too late and injury to buds result, or if the heaters are lighted before the danger point is reached fuel is lost which may be needed at a critical time before sunrise. An electric alarm thermometer can be secured for about \$20, which will ring an alarm when the danger point at which it is set is reached. This will save considerable loss of sleep, which is valuable if several frosty nights are experienced and when the spraying season demands attention. It will be well to place the thermometer by which the fires are to be lighted in the lowest part of the orchard. Cool air settles in low places, and these are often much cooler than the higher points.

The temperature at which the fires shall be lighted will depend upon the predicted temperature for the night and the rapidity with which the temperature falls. If a very cold period is expected, or if the temperature is falling rapidly, the fires should be lighted when the temperature is several degrees above the danger point, probably 33°.

If but little frost is expected, or if the temperatures are falling slowly, the heaters need not be lighted until the temperature very nearly reaches the danger point, 29° or 30°. Heaters were fired at 30° in the work last spring because the temperature was falling rapidly, and yet the temperature did not go lower. This fuel was lost, and yet had the temperature continued to fall it would have been difficult to have kept the temperature above the danger point.

Any estimate on the cost of heating an orchard must be approximate because of the variable factors which enter. Equipment, cost of fuel, distance from railroad siding and length of firing period vary in different localities and seasons. The following estimate for a 10-acre orchard is submitted as a guide only. Sixty-five or more large heaters of two gallons or greater capacity are recommended.

650 heaters at 30c to 50c each.	\$195.00 to \$325.00
3,000 to 6,000 gallons oil at 3c.	90.00 to 180.00
One steel wagon tank.....	15.00 to 25.00
Lighters, torches, etc.....	6.00 to 10.00
Thermometers	6.00 to 8.00
Storage for oil at 75c barrel..	63.30 to 126.00

Total\$375.30 to \$674.60

If smaller heaters are used more will be required, and thus the cost will vary but little. Labor items are omitted.

At firing time two men ought to handle the ten acres at a cost of \$5 to \$6. This equipment will last for several years, and after the first year labor and fuel will be the only expense, and should not exceed \$10 to \$20 per acre annually. If the crop is well cared for it is worth from \$100 to \$400 per acre, and such a small cost is good insurance. Such insurance is not recommended for the man who does not make his orchard produce maximum crops.

The orchardist should provide himself with such information and equipment as will enable him to know when to expect frost and freezing temperatures. The United States Weather Bureau sends out daily forecasts for the succeeding 24 hours. At a very low cost these can be secured from the nearest station by telephone or telegraph. If a weather map is available it will help to make the predictions more valuable. The orchardist should supplement the forecasts sent out by the weather bureau by his own observations. Local conditions influence the temperature and humidity to a large extent. The sling psychrometer is used for measuring the dew point or the temperature at which dew will form. There is a close relationship

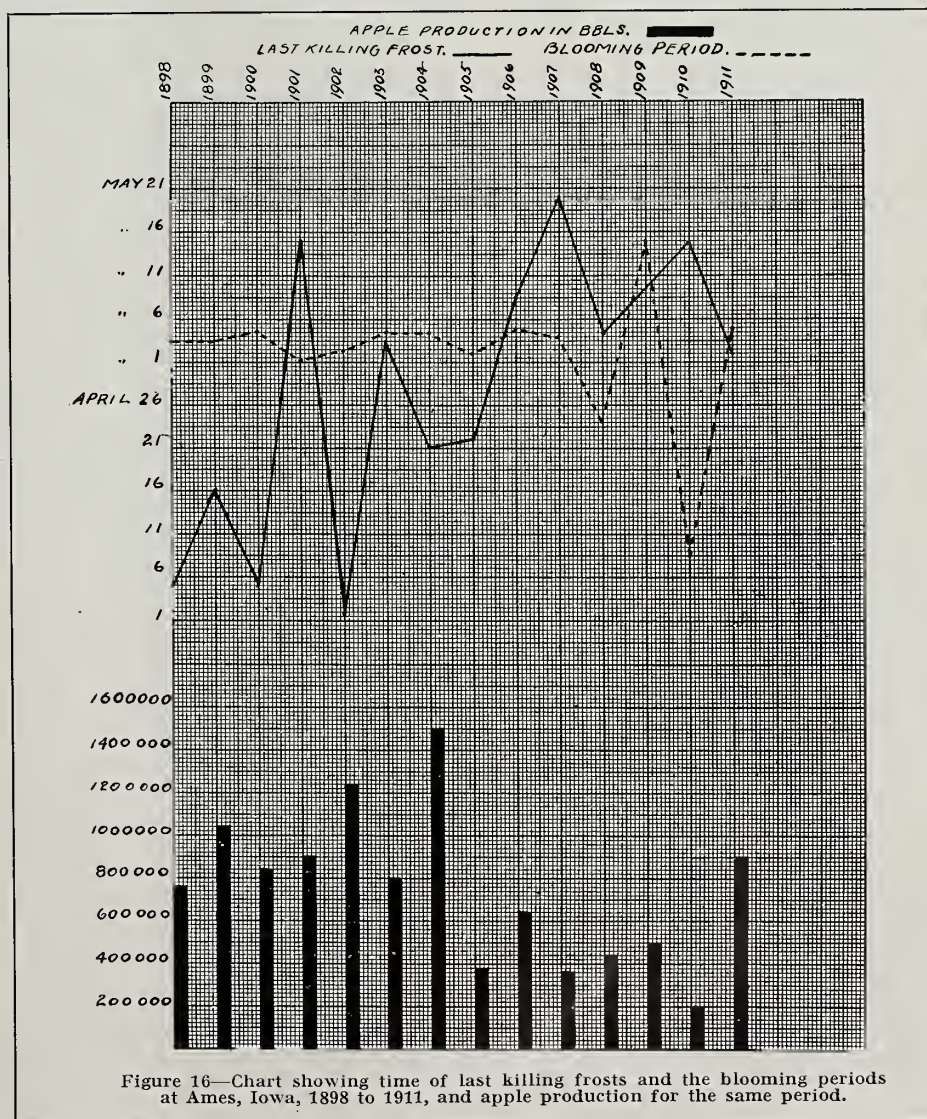


Figure 16—Chart showing time of last killing frosts and the blooming periods at Ames, Iowa, 1898 to 1911, and apple production for the same period.

TABLE III.—FOR DETERMINING TEMPERATURE OF DEW-POINT IN DEGREES FAHRENHEIT

Air tempera- ture	Dew-point when difference between wet-bulb and dry-bulb temperatures is														
	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°
35°	33	30	28	25	22	18	14	8	1	-8	-28	...	...	...	...
36°	34	31	29	26	23	20	15	11	4	-4	-19	...	...	...	...
37°	35	32	30	27	24	21	17	13	7	-1	-12	-44	...	...	...
38°	36	33	31	28	26	23	19	14	9	3	-7	-25	...	...	...
39°	37	34	32	29	27	24	21	16	12	6	-3	-16	...	...	...
40°	38	35	33	31	28	25	22	18	14	8	1	-10	-35	...	...
41°	39	37	34	32	29	26	23	20	16	11	4	-5	-21	...	...
42°	40	38	35	33	30	28	25	21	17	13	7	-1	-13	-59	...
43°	41	39	36	34	31	29	26	23	19	15	10	3	-7	-28	...
44°	42	40	38	35	32	30	27	24	21	17	12	6	-2	-17	...
45°	43	41	39	36	34	31	29	26	22	19	14	8	2	-9	-37
46°	44	42	40	37	35	32	30	27	24	20	16	11	5	-4	-20
47°	45	43	41	39	36	34	31	28	25	22	18	13	8	0	-12
48°	46	44	42	40	37	35	32	30	27	23	20	15	10	4	-6
49°	47	45	43	41	39	36	34	31	28	25	21	17	13	7	-2
50°	48	46	44	42	40	37	35	32	29	27	23	19	15	9	2
51°	49	47	45	43	41	39	36	34	31	28	25	21	17	12	6
52°	50	48	46	44	42	40	37	35	32	29	26	23	19	14	9
53°	51	49	47	45	43	41	39	36	34	31	28	24	21	16	11
54°	52	50	49	47	44	42	40	38	35	32	29	26	23	19	14
55°	53	52	50	48	46	43	41	39	36	34	31	28	24	21	16
56°	54	53	51	49	47	45	43	40	38	35	32	29	26	23	19
57°	55	54	52	50	48	46	44	42	39	36	34	31	28	24	21
58°	56	55	53	51	49	47	45	43	40	38	35	32	29	26	22
59°	57	56	54	52	50	48	46	44	42	39	37	34	31	28	24
60°	58	57	55	53	51	49	47	45	43	41	38	35	32	29	26
61°	59	58	56	54	52	51	49	46	44	42	39	37	34	31	28
62°	60	59	57	55	54	52	50	48	46	43	41	38	35	32	30
63°	61	60	58	56	55	53	51	49	47	45	42	40	37	34	31
64°	62	61	59	58	56	54	52	50	48	46	44	41	38	36	33
65°	63	62	60	59	57	55	53	51	49	47	45	43	40	37	34
66°	64	63	61	60	58	56	54	53	51	48	46	44	42	39	36
67°	65	64	62	61	59	57	56	54	52	50	48	45	43	40	38
68°	67	65	63	62	60	58	57	55	53	51	49	47	44	42	39
69°	68	66	64	63	61	60	58	56	54	52	50	48	46	43	41
70°	69	67	66	64	62	61	59	57	55	53	51	49	47	45	42

between the dew point and the minimum temperature of the night, providing the observations are made late in the evening and the sky remains clear, with but little wind. The following description of the sling psychrometer is taken from United States Weather Bureau publication W. B. No. 235: "Measurement of Atmospheric Moisture—The quantity of moisture mixed with the air under different conditions of temperature and degree of saturation may be measured in several distinctly different ways. Many of these, however, are not practical methods for daily observations, or are not sufficiently accurate. Probably the most convenient of all methods and the one most generally employed is to observe the temperature of evaporation—that is, the difference between the temperatures indicated by wet and dry-bulb thermometers. The most reliable instrument for this purpose is the sling or whirled psychrometer. In special cases rotary fans or other means may be employed to move the air rapidly over the thermometer bulbs. In any case satisfactory results cannot be obtained from observations in relatively stagnant air. A strong ventilation is absolutely necessary to accuracy.

"Sling Psychrometer—This instrument consists of a pair of thermometers provided with a handle, which permits the thermometers to be whirled rapidly, the bulbs being thereby strongly affected by the temperature and the moisture in the air. The bulb of the lower of the two thermometers is covered with thin muslin, which is wet at the time an observation is made.

"The Wet Bulb—It is important that the muslin covering for the wet bulb be kept in good condition. The evaporation of the water from the muslin always leaves in its meshes a small quantity of solid material which sooner or later somewhat stiffens the muslin so that it does not readily become wet after being dipped in

water. On this account it is desirable to use as pure water as possible, and also to renew the muslin from time to time. New muslin should always be washed to remove sizing, etc., before being used. A small rectangular piece wide enough to go about one and one-third times around the bulb and long enough to cover the bulb and that part of the stem below the metal back is cut out, thoroughly wetted in clean water and neatly fitted around the thermometer. It is tied first around the bulb at the top, using a moderately strong

thread. A loop of thread to form a knot is next placed around the bottom of the bulb, just where it begins to round off. As this knot is drawn tighter and tighter the thread slips off the rounded end of the bulb and neatly stretches the muslin covering with it, at the same time securing the latter to the bottom.

"To Make an Observation—The so-called wet bulb is thoroughly saturated with water by dipping it into a small cup or wide-mouthed bottle. The thermometers are then whirled rapidly for fifteen or twenty seconds, stopped and quickly read, the wet bulb first. This reading is kept in mind, the psychrometer immediately whirled again and a second reading taken. This is repeated three or four times, or more if necessary, until at least two successive readings of the wet bulb are found to agree very closely, thereby showing that it has reached its lowest temperature. A minute or more is generally required to secure the correct temperature. These readings are then referred to what are known as psychrometric tables, from which the temperature at which the dew or frost will form may be found."

Psychrometric readings should be made late in the evening and the dew point will be approximately the lowest temperature of the following night. Practice in making these readings and records of the predicted dew point and lowest temperatures occurring for several nights previous to the frosty time will familiarize the observer with the use of the instrument. Table III is a reprint of the psychrometric table

TABLE IV.—DATES OF LAST KILLING FROST IN SPRING

Year	Charles City	Davenport	Des Moines	Dubuque	Keokuk	Sioux City
1873	.....	April 8	.....	.....	.....	.....
1874	.....	April 28	.....	April 17	April 23	.....
1875	.....	May 2	.....	May 2	May 2	.....
1876	.....	May 1	.....	May 1	April 2	.....
1877	.....	April 30	.....	May 1	April 3	.....
1878	.....	March 28	.....	March 28	March 4	.....
1879	.....	April 17	April 18	April 5	April 13	.....
1880	.....	April 11	April 19	April 15	April 17	.....
1881	.....	April 14	April 15	April 1	April 16	.....
1882	.....	May 22	May 22	May 2	March 26	.....
1883	.....	May 22	April 2	May 21	April 24	.....
1884	.....	April 22	April 10	April 21	April 8	.....
1885	.....	May 9	May 7	May 11	April 8	.....
1886	.....	April 8	April 7	April 8	April 6	.....
1887	.....	April 26	April 25	April 16	April 5	.....
1888	.....	May 13	April 20	May 13	April 20	.....
1889	.....	April 6	April 6	April 6	April 6	.....
1890	.....	May 6	May 16	May 6	April 10	May 7
1891	.....	May 5	May 11	April 12	April 7	April 7
1892	May 29	April 15	April 29	April 15	April 6	May 7
1893	May 4	April 13	April 23	April 23	April 23	May 3
1894	May 19	April 8	May 19	April 8	April 12	May 19
1895	May 21	May 14	May 12	May 14	April 14	May 21
1896	April 21	April 8	April 8	April 8	April 4	April 19
1897	April 20	April 17	April 20	April 20	April 19	April 29
1898	May 6	April 7	April 4	April 7	April 6	April 26
1899	May 13	April 16	April 16	April 16	April 16	May 4
1900	May 5	April 5	April 4	April 9	April 13	May 4
1901	April 21	April 21	April 20	April 21	April 18	April 19
1902	April 24	April 15	April 4	April 15	April 8	April 23
1903	May 3	Marh 30	May 3	April 30	May 1	April 30
1904	May 9	April 21	April 19	April 21	April 21	April 27
1905	April 30	April 18	April 18	April 16	April 17	April 18
1906	May 9	May 7	April 6	April 2	April 1	May 6
1907	May 20	May 11	May 4	May 4	May 4	May 7
1908	May 3	May 2	May 2	May 3	May 2	May 2
1909	May 3	May 3	May 3	May 3	May 2	May 10
1910	May 4	April 25	April 24	May 1	April 25	May 3
1911	May 3	May 2	April 9	May 2	April 9	May 2

The averages of the above are given below:			
	Length of record, Years	Average date of last frost in spring	Date of latest frost in spring
Charles City	17	May 16	May 29
Davenport	35	April 22	May 22
Des Moines	31	April 22	May 22
Dubuque	35	April 21	May 21
Keokuk	37	April 11	May 4
Omaha, Nebraska	38	April 16	May 19
Sioux City	19	May 4	May 21



“Better Fruit” Ready for Mailing, 1912

when the air pressure is 29 inches, which is close enough to our conditions for practical purposes.

While the last killing frost is known for many years past among the different stations in Iowa, it is impossible to secure records of the blooming time for the apple over a greater period of time than from 1898 to 1911. The chart (figure II) shows in a graphic way the date of the last killing frost at Ames and the date of blooming for the apple at Ames. The perpendicular lines represent the total yield of apples for the state in barrels. During the period from 1898 to 1904 the average annual production was very high, and it will be noted that the latest killing frost in the spring came some time before the blooming period, so that the bloom did not suffer from frost injury. It is hard to determine the cause for the low yield in 1905, when the last killing frost occurred ten days previous to the blooming period, but this chart represents only a few localities and it is possible that the more important fruit districts were frosted during this season.

From 1905 to 1910 the last killing frost came after the trees were in bloom, with the exception of 1909. This period covers years of a comparatively low yield. Why the yield in 1909 should not have been greater, owing to the fact that the blooming period came after the last frost, is problematical; but no doubt the orchards had been so long neglected, owing to unproductiveness, that when there was opportunity for them to bear heavy crops they were not in condition to do so. The blooming period and the last killing frost were very close together in 1911, and owing perhaps to weather conditions and to the fact that the bloom was not very far advanced little injury resulted. The chart illustrates in a limited way how crop production is affected by the relationship of frost to the blooming period. Table IV gives the dates of the last killing frost in the spring at the weather bureau stations noted. By referring to the record of the nearest station each grower can estimate the danger period for his locality. Differences in latitude should be considered.

die. What becomes of the few that are necessary to perpetuate the species is not definitely known. It is supposed that they migrate to some other food plant. An Eastern entomologist states that a few sexual females return to the apple trees in the fall and lay a small number of eggs. The leaf-curling aphid, like other plant lice, sucks the sap and does not eat the surface of the leaves. It also produces a considerable amount of honey dew, but the black smut fungus does not appear to thrive on it, so the trees seldom become black as a result of the work of this species.

Often this aphid attacks only a few twigs on a tree in a single season.

The Leaf-Curling or Purple Aphid

By W. H. Volck, Entomologist, Watsonville, California

THE leaf-curling aphid is usually the first plant louse to appear in the spring. It attacks all varieties of apples and can be recognized by the pronounced effect on the shoot it infests. The leaves curl in toward the under surface, where the colonies of aphids are located. This curled foliage has a sickly, yellow-green color and a more or less rumpled surface. The distortion and twisting is also apparent in the shoot which bears the leaves. When a fruit spur is attacked the apples also suffer seriously, and in most cases are rendered worthless. The poison injected by the aphids causes an abnormal number of fruits to set, but the “aphid apples” do not grow normally. They often get no larger than a walnut, are much deformed and do not develop the normal flavor or character of pulp. The reactions produced by the aphid are undoubtedly due to the injection of a toxic substance

in much the same manner as a mosquito injects poison at the same time that it is sucking blood from an animal. The poison injected by the aphid travels along the shoot and starts leaves to curling which have not yet become infested. This provision of nature works to the advantage of the aphid as a shelter is provided for the insect in advance of its coming.

The full life history of this insect is still in doubt. In the spring it is in the unsexual form. All the individuals are females and bear living young (do not lay eggs). Some of these females develop wings and so are able to fly to other branches or trees and start new colonies. This process does not continue through the season, for in the month of June all the individuals suddenly develop wings and fly from the trees. They do not establish new colonies, but appear to wander aimlessly about and the great majority of them

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Under such conditions the damage is trifling and can be overlooked; but under other conditions the infestation may be general, resulting in a great loss to the apple grower. This aphid is capable of destroying the entire crop, and has done so in several local orchards for the past three years. The behavior of this pest cannot be predicted in advance. Much, if not all, depends on the nature of the early spring season, and we have not yet determined just what the factors are which favor the increase of this plant louse.

Owing to the fact that the leaf-curling aphid colonies are almost always protected under the curled up foliage effective spraying is very difficult. The only method that has proved successful is to begin early, while the trees are yet in bloom. At this time the aphid is just starting to increase and not many leaves will be curled up tight, so that thorough spraying of the under surface of the foliage will reach most of the insects. In addition to this spraying a very careful watch must be kept and the application repeated whenever there is any sign of increase. In some cases it may require three or four sprayings to prevent undue injury. Formula: "Black Leaf 40" (nicotine sulphate containing 40% nicotine), 1 pound (about $\frac{1}{10}$ gallon); whale-oil soap, 10 pounds, or cresol soap, 1 gallon; water, 200 gallons.

When whale-oil soap is used it must be melted in boiling water. Add the melted soap to the water in the spray tank and start the agitator, then add the "Black Leaf 40" and continue agitation until thoroughly mixed. Cresol soap is a liquid and requires no heating. Add it directly to the water in the spray tank, agitate and add the "Black Leaf 40" as before. In our experiments the cresol soap has proved superior to

whale-oil, as the cresol forms a compound with nicotine which appears to be more poisonous than the free nicotine. Soap of any kind improves nicotine sprays because the penetrating and wetting power is increased by the addition. Smaller quantities of this spray can be made by using proportional weights of the materials, thus one-quarter pound of "Black Leaf 40" and one quart of cresol soap makes fifty gallons of spray. The trees must be thoroughly drenched with this spray to do good work. It will require at least double the amount commonly applied for the codling moth. The nicotine spray kills by contact with the bodies of the aphids and the insects will escape unless they are thoroughly soaked.

Nicotine sprays, when used alone, have caused no injury to the foliage or fruit, but when combined with the bordeaux mixture serious injury has resulted, due to the liberation of soluble copper. For this reason nicotine should not be combined with the bordeaux mixture. These sprays should be applied separately, and if close together the nicotine should be put on first. If it is desired to use a fungicide along with a nicotine spray it had best be iron sulphide, usual strength; arsenate of lead may also be added. With these combinations, however, the soap recommended with the straight nicotine had best be omitted.

As a result of the accidental observation of the effect of strong lime-sulphur solution, Mr. G. F. Gallagher of Agnew, California, found that apple trees which received the application were practically immune to the aphid, while adjoining unsprayed trees were very badly attacked. Mr. Gallagher first observed this difference two years ago. Last year he did some spraying with special regard for the aphid and

the results were similar. The observations of Mr. Gallagher are confirmed by Mr. Earl L. Morris, horticultural commissioner for Santa Clara County. The lime-sulphur solution was about one-half stronger than that usually used for the San Jose scale and the application was made after the buds had begun to swell. It is probable that ordinary strengths of lime-sulphur would have the same effect, but in lesser degree. A notable fact in this connection is that the orchards in the Pajaro Valley which have suffered most from the leaf-curling aphid are those that have not been winter sprayed. In our sprayed orchards, however, there has always been some damage from the aphid. Aphid was also reported on the trees sprayed by Mr. Gallagher, but the pest did not increase enough to do any damage. This apparent control is probably not due to the killing the winter eggs, as the aphid on nearby trees could quickly reinfest those sprayed. The effect is apparently due to the establishment of a sort of immunity in the tree, a curious result when it is remembered that sulphur applied during the spring and summer increases the tendency to become infested with aphids. To duplicate Mr. Gallagher's work the commercial solution should be applied one to six, and the home-made formula should contain 90 pounds of sulphur and 45 pounds of lime to 200 gallons. The spray is applied when the buds are swelling or the latter part of March. After the opening of the buds and at the time the first blossoms are appearing the concentration must be reduced to ordinary winter strength or less. It is probable that ordinary winter spraying done at this time should give reasonably good results as an aphid preventive.

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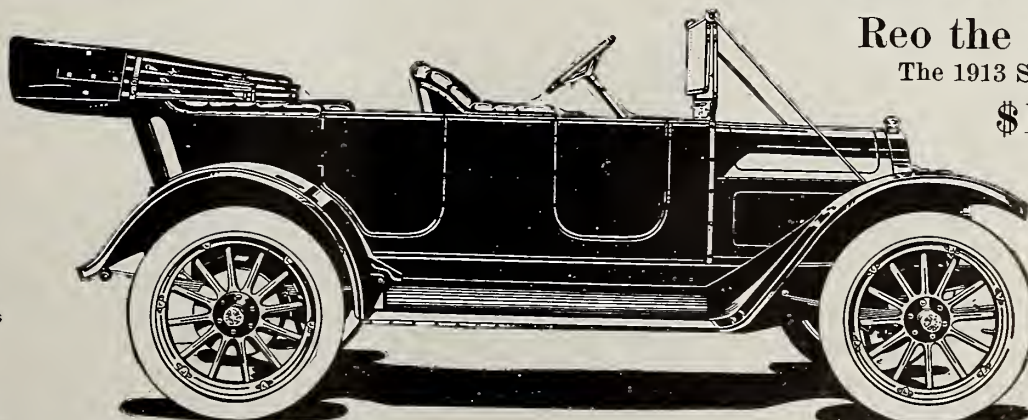
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(135)

Strawberry Growing in the West Kootenay District, B. C.

By M. S. Middleton, Assistant Provincial Horticulturist, Nelson, British Columbia

THE possibilities of successful strawberry growing in the Kootenay has been fairly well demonstrated to be one of the most profitable adjuncts to general fruit growing. The character of the soil, along with the ideal climatic conditions, to produce a large crop of the highest quality berries in color and flavor has been the means of creating considerable favorable com-

varied, depending almost wholly upon the grower and the condition and preparation of the soil and the cultivation and attention given the patch. As an instance, the average yield per acre in this district has been estimated at less than two hundred crates per acre, while individual growers have reported yields of from 400 to 600 crates per acre in a good season. Mr.

about three or four pounds of brown sugar added to sweeten it, gave good results where it was applied to the patch in good time in the spring.

The varieties which are most commonly grown in the district for the factory are the Glen Mary, Wm. Belt, Royal Sovereign and the New York. Those for shipping are the Magoon, Royal Sovereign and the Parsons Beauty; the softer of the berries being sold in crates locally. The Magoon is a good berry and is probably the most widely known. It is a very dark-colored berry and is not so attractive when put up as jam as is the Glen Mary or Wm. Belt, which are lighter colored berries with large light-colored seeds, giving them a very attractive appearance when put up as jam, especially when put up in glass. The Glen Mary, Wm. Belt and New York yield somewhat larger crops than the Magoon.

Unquestioning the demand for the berries and the adaptability of the district for the growing of them, we must be attracted by the great variance of crop yields obtained. It will be the endeavor in the balance of this article to give the practices followed by the most successful growers in the district. It costs about 60 cents to pick and pack a 24-pound crate of strawberries. The total expense in growing a crate of strawberries is estimated at about \$1.20 per crate, calculated on a 250-crate yield per acre. It will be seen that as the yield is increased the cost of production per crate will be decreased, and consequently greater profits realized. The estimated cost of planting out and caring for an acre of strawberries is calculated at from \$115 to \$125 per acre, depending on local conditions and facilities.

The methods employed and the selection of the sites should receive the first

Continued on page 43



A Good Type of Home-made Leveler

ment from those capable of judging the merits or demerits of the Kootenay berries. Mr. H. Beach, the processor of the Kootenay Columbia Jam Factory at Nelson, B. C., who has had a wide experience in the canning and in jam-making business in the old country and in the West, remarks: "The West Kootenay district is remarkably well adapted to the growing of strawberries and other small fruits. I have never in all my experience as a jam maker found berries of a richer flavor, color and general high quality than those grown in this district. The weather conditions are most favorable and the demand is very great. The total output of our factory this year (six carloads) was disposed of in two months. We cannot procure the amount of fruit which we could handle. If we had had five times the amount of strawberries we could have easily disposed of them locally. We find that strawberries and raspberries are our best sellers."

The prices which have been paid by the canning and jam factories in this district this year were five cents per pound when the company did the picking, and six cents per pound when the growers picked them, and six and one-half cents per pound when the growers picked and hulled the berries. The company paid the freight or express charges to the factory. Where the berries were shipped out in crates the prices realized ranged from \$2 to \$4 per 24-pound crate f.o.b. point of shipment. A fair average price that might be depended upon would be about \$2.60 per crate. The yield and profits from strawberries in the Kootenays are very

O. J. Wigen, at Wyndall, has produced as high a yield as 14,000 pounds, or about 600 crates per acre, and an average of some 400 crates per acre during a fair season, on some seven or eight acres which he devotes to the crop. Last season the berry crop in the Kootenay was badly effected by cut worms. In some instances the plants were completely ruined, while in others they were injured sufficiently to materially affect the bearing of the plants. Applications of paris green and bran in the proportion of one pound of paris green to fifty pounds of bran, with



Strawberries as an Intercrop in the West Kootenay District

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Now This Winter Tread

Our latest perfection is this ideal Non-Skid. It avoids all the usual shortcomings.

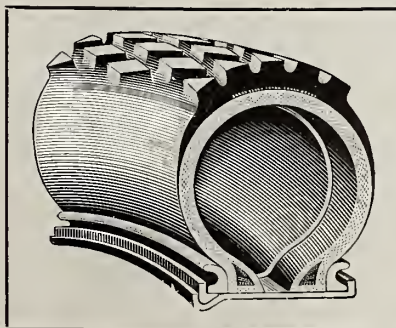
It's a double-thick tread, made of very tough rubber. The blocks are deep-cut and enduring.

They present to the road surface countless edges and angles, which grasp with a bulldog grip.

These blocks meet at the base, so the strain is distributed over the fabric just as with smooth-tread tires. This invention alone doubles the life of non-skids.

There's nothing else so efficient, nothing so enduring, in the whole range of non-skid treads. One glance will tell you this.

Write for the Goodyear Tire Book—our 14th-year edition. It tells all the ways to save on tires.



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AKRON, OHIO

No-Rim-Cut Tires

With or Without Non-Skid Treads

The Goodyear Tire & Rubber Company, Akron, Ohio

Branches and Agencies in 103 Principal Cities

More Service Stations Than Any Other Tire

We Make All Kinds of Rubber Tires, Tire Accessories and Repair Outfits

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Planet Jr

Get these time-saving, labor-lightening farm and garden tools to secure the greatest yield from your crops. They are scientific soil-tillers—the result of a practical farmer's more than 40 years' experience. Light, strong, and lasting. Fully guaranteed.

No. 4 Planet Jr Combined Hill and Drill Seeder, Wheel Hoe, Cultivator, and Plow does the work of almost all garden tools combined. It sows accurately *all* garden seeds, cultivates, hoes, furrows, and plows. Indestructible steel frame.

No. 8 Planet Jr Horse Hoe and Cultivator does more kinds of work better, quicker, and easier than any other cultivator. Indispensable on the up-to-date farm. Can be fitted with plow and disc attachment and all-steel wheel—new this year.

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S L ALLEN & CO
Box 1106U
Philadelphia




Larval Form of the Canker Worms

By W. H. Volck, Entomologist, Watsonville, California

THE larval form of the canker worms is a caterpillar that travels with a looping movement, and is sometimes called span worm or measuring worm. These larvae are hairless and vary in size according to the age of the insect, from one-eighth to one and one-half inches in length. The color varies with individuals of the same species. Some are green with narrow, light lines running along the sides of the bodies, others are gray, and still others are black with or without lines. These variations are placed in two groups by orchardists who have had experience with them, that is, green and black canker worms. Canker-worm larvae feed on many varieties of fruit, shade and forest trees. They are heavy feeders and if numerous will defoliate the trees. If the foliage is much reduced by this feeding the canker worms attack the tender stems and young fruit. The gouges in the fruit result in much the same kind of a scar as that produced by the tussock caterpillar. These insects are present only in the spring of the year, and if disturbed drop from the branches and hang at the end of long webs. The caterpillars reascend these webs as soon as the disturbance has ceased.

Canker worms are the larvae of a moth. Two species are frequently present known as spring and fall canker worms. The fall canker worm is the most common in our orchards, and in fact may often be the only species present. These insects have but one generation a year. When the caterpillars become full grown they leave the trees and enter the ground, where transformation into chrysalids, and finally adult moths, takes place. These moths emerge either in the late

summer, fall or spring, according to the species. The females are wingless and must climb the trees in order to deposit their eggs. These eggs are deposited in patches on the branches, where they remain until the young caterpillars hatch in the spring. The larvae grow in the same manner as those of other moths and butterflies. The skin is shed several times and full growth is reached in thirty to fifty days, according to the climatic conditions. All of the eggs do not hatch at the same time, so there will be a number of sizes of larvae on the trees, especially early in the season. Hatching begins with the swelling of the leaf buds and continues for three or four weeks. The caterpillars do not travel from the trees where they hatched unless the food supply is exhausted.

The injury resulting from canker worm infestation depends on the number of insects present, and may vary from slight marring of the foliage to partial or complete defoliation, with great injury to the crop. Complete defoliation often causes a crop failure the following year, but the trees are seldom, if ever, permanently injured. Canker worms are more persistent from year to year than the tent caterpillars, or even the tussock caterpillar. A recurrence of the trouble may be expected in any orchard where this insect was abundant the previous season.

Trapping the moths when they ascend the trees is a method suggested by the life history of the insect. Various kinds of band traps have been employed. A screen cone secured firmly against the trunk, so that the moths are stopped from direct ascent but must travel down on inner surface of cone and finally over its projecting edge, is one

of the most successful types. Tangle-foot sticky bands also stop the moths, and when properly tended should be quite effective. All such bands and traps must be applied in the fall and tended until the moths cease emerging in the spring. While such methods can be made successful by sufficient attention, the practical difficulties are great, and the traps have largely been discarded in favor of spraying with arsenicals to poison the young worms.

As the caterpillars devour the entire foliage they are also obliged to eat any poisonous material which may be deposited in the form of a spray. Arsenic is the poison universally used for such work, and in order to prevent damage to the trees it is combined with some material that will render it insoluble in water. The degree to which the arsenical must be free from foliage-injuring properties depends on the kind of trees sprayed, locality and time of the application. Stone fruits are more easily injured than apples and pears, and the moist climate of the Coast makes arsenic burning more serious than it can become in the dry interior valleys.

The most insoluble and weather-resistant compound of arsenic now obtainable is neutral or Ortho arsenate of lead. This compound can be used on all varieties of trees at any time and in any climate without danger of serious injury. It acts as a stomach poison and will control canker worms, codling moth, tent caterpillars and several other insects. This poisoning is slower than with more soluble arsenicals and the applications must be thorough to assure success. Acid and Pyro arsenate of lead is another compound at once cheaper, more poisonous to insects and more injurious to plants than the Ortho compound. This arsenate can be used in the dry interior valleys, on apples and pears, through-

Continued on page 45

BERRY PLANTS

BEST AND CHEAPEST

Illustrated Price List

LOUIS F. SCRIBNER

Department B

Pasadena, California

Tree Planting and Stumping POWDER

An honest product made by an Independent Home Company.

Are you going to plant trees or clear land this year?

Have you heard of "Imperial," the new explosive—superior substitute for dynamite and "King of all Powders"?

Won't freeze—no headache—safer than dynamite and does the same and better work with less powder.

Sold to you direct from the factory in any quantity from one box up at the same price that dealers pay for dynamite in carloads.

You buy "Imperial" by the box as cheap as they can buy dynamite from the manufacturer in carloads, and save middlemen, jobbers and dealers' profits.

Write. Let us tell you all about this powder, and prices, and how much money we can save you. Glad to answer letters.

IMPERIAL POWDER COMPANY

Drawer Y

Chehalis, Washington, U. S. A.

HURST SPRAYERS

SENT ON FREE TRIAL

No Money In Advance—We Pay Freight



Man-Power Potato and Orchard Sprayer
MAN-POWER POTATO AND ORCHARD SPRAYER

Sprays anything—trees, vineyards, potatoes, truck, etc.—Develops high pressure, easy to operate, generates pressure automatically as you push it along in field work. Sprays four rows. Pumped by hand in orchard work. Perfect agitation. High, broad-tired wheel makes it easy to push—horse hitch for hilly country—10 and 20 gallon tanks—heavy brass plunger, valves, strainer, etc. No leather or rubber to cause trouble. Cheap in price. Light, strong and durable. Guaranteed five years. Send coupon or write today—be first.

"FITZ-ALL" BARREL SPRAYER

For tree spraying—a sturdy built, high quality machine. Develops high pressure, and is easy to operate.



Fitz-All Barrel Sprayer

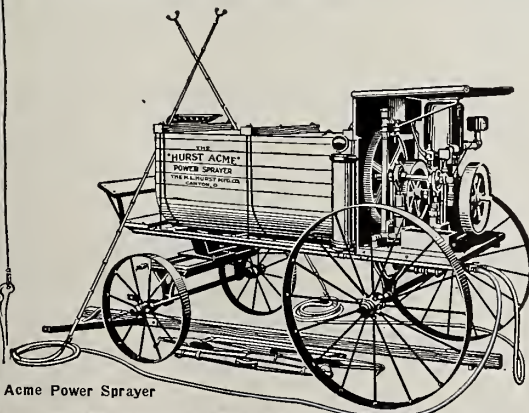
Vacuum and paddle agitator—works over strainer—prevents clogging. Brass Ball Valves, Strainer, Packer Band, Plunger, etc. Large capacity—furnished mounted on barrel or plain. Five year guarantee. Send coupon or write today—be first.



Horse-Power Potato and Orchard Sprayer

HORSE-POWER POTATO AND ORCHARD SPRAYER

For orchard and field spraying—60 and 100 gallon tank, for one or two horses. Works automatically in field and orchard—no hand pumping required. High pressure, thorough agitation. Saves time, labor and money. Requires only one man to operate. Has heavy steel axle, cypress wood tank, one-piece heavy angle steel frame, broad tired metal wheels, brass valves, cylinders, plunger and strainer. Guaranteed for five years. Shipped on free trial—Write or send coupon today.



Acme Power Sprayer

POWER ORCHARD SPRAYER

For large fruit growers. 100 and 200 gallon tanks—short turn gear, light weight, powerful pressure, automatic pressure regulator, cyclone agitator and a 2½-h.p. four-cycle engine that never fails. It is vertical, frost-proof, water-cooled, simple in construction—an engine any boy can operate. Engine can be relieved of load when nozzles are shut off. You can easily remove engine from sprayer and use for other work. Duplex pump with outside packing. Many other exclusive, practical features fully described in catalog. Free Trial—five year guarantee. Send coupon or write today—be first.

Our Offer

Without paying one cent in advance—without making any bank deposit—or signing any notes, we will ship any Hurst Sprayer to your nearest railroad station, and let you use the sprayer ten days free of charge. If you don't want to keep the sprayer after trying it for ten days, ship it back at our expense. If you decide to keep the sprayer you can either pay cash or we will wait a whole season for our money, which you can easily pay out of the increased profits. Write for our catalog today, and pick out the sprayer you need. We pay freight.

Spraying Increases Profits

Scabby fruit brings 50 per cent less than fruit that has been sprayed. In these days, when insects and fungous pests are ever on the increase, spraying is absolutely necessary. What's the use of fertilizing, cultivating, pruning, etc., and then letting your trees die or your fruit become specked and scabby for want of spraying? Buy a Hurst Sprayer now, and increase your profits.

Hurst Sprayers Highest Quality

The quality of Hurst Sprayers cannot be exaggerated. We buy the finest raw materials and put over 26 years' practical experience into the making of every sprayer. All Hurst Sprayers have brass ball valves, brass plungers and brass cylinders. They agitate thoroughly, develop high pressure, and are easy to operate, strong and durable. That's why every sprayer is backed by

Our 5-Year Guarantee

It is conclusive evidence that the material, workmanship and efficiency of Hurst Sprayers are absolutely perfect. In the spraying machine contest held by the Horticultural Congress at Council Bluffs, Iowa, in November, 1910, the gold medal was awarded a Hurst Sprayer. This contest was open to the whole world and proves the superiority of our product.

Valuable Spraying Guide Free

To our customers. It shows all the insect and fungous pests, describes them fully, gives remedies and other valuable information. Our Free Information Bureau gives advice without charge on insect or pest troubles. This is open to you, whether you buy a sprayer or not.

Money Saving Offer

If you are the first in your locality this season to get a Hurst Sprayer on free trial, we have a plan that will give you your sprayer entirely free—without you paying even the freight. This offer does not require you to do any canvassing or soliciting. It will take only fifteen minutes of your time. We do the work. Fill out the attached coupon or write us today telling us which machine you are interested in and we will send you Free our big catalog and condensed spraying guide and we will tell you all about our Free Sprayer Offer and our Free Trial proposition. Don't delay, but write us at once and save money.

Mail This Coupon Today

**H. L. HURST
MFG. CO.**

8224 NORTH STREET, CANTON, OHIO
152 UNION AVENUE, PORTLAND, OREGON

If you don't know which sprayer to use we'll advise you.

FILL OUT, MAIL TODAY

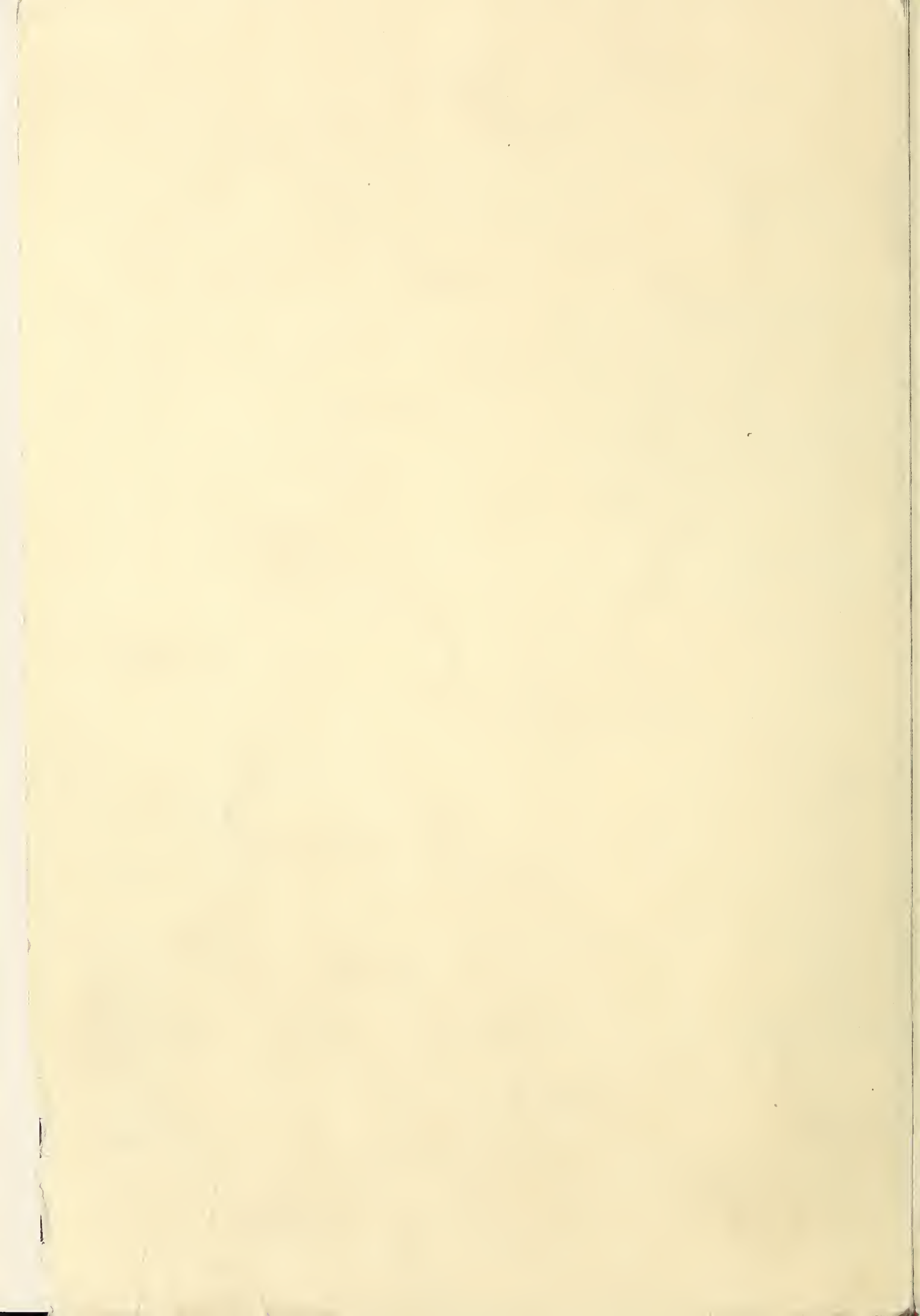
H. L. HURST MANUFACTURING CO.
8224 North Street, Canton, Ohio
152 Union Avenue, Portland, Oregon

COUPON

Please send me full detailed information about your

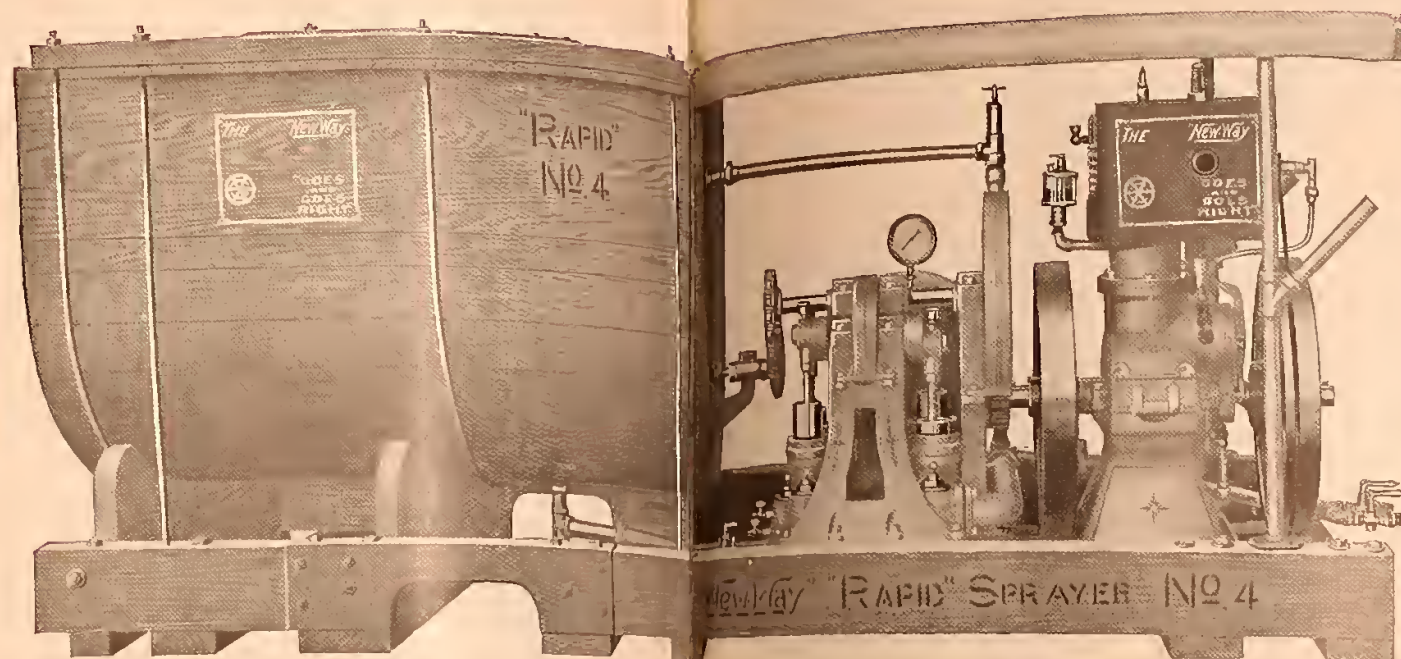
..... Sprayer.
Also catalog, condensed spraying guide and copy of Trial Offer.

Name
Town
State

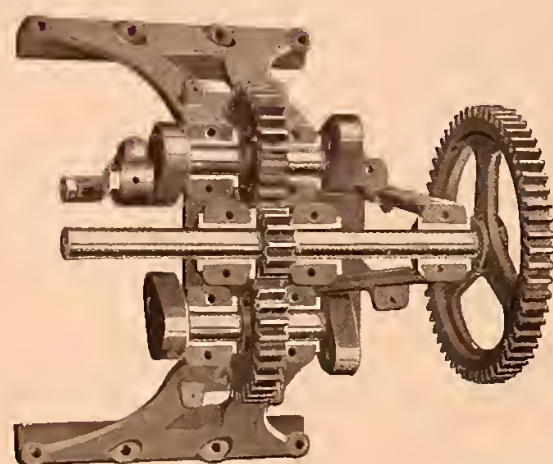


"New Way" Rapid Power Sprayers

**TWO OR FOUR
CYLINDER**



**WOOD AND STEEL
FRAMES**



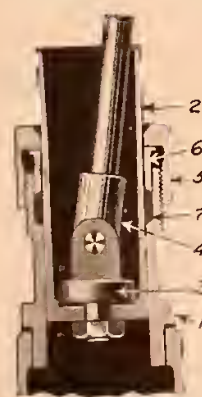
No. 4 RAPID DRIVING MECHANISM. The No. 2 Rapid Pump has same construction adapted to two cylinders.

The drive shafts are straight and the bearings are large and only one inch apart.

This is the rigid, durable construction that enables the Rapid Pump

to carry high pressure easily and without undue strain or wear. All gears are cut.

RAPID CYLINDER. Interchangeable on No. 2 and No. 4



Rapid Cylinder

1. Cylinder—screws into waterway.
2. Piston—special bronze casting—outside packed.
3. Forged steel clevis—for connecting rod—making a high-class connection that will stand the strain of high-pressure work.
4. Connecting rod is forged steel.
5. Stuffing nut—turns down on thread on the cylinder against the gland (6), tightening the packing (7). This adjustment can be made while the sprayer is running. The piston is kept properly packed all the time.

"New Way" RAPID POWER SPRAYERS

are built in one factory. They are not assembled. They will maintain high pressures continuously, because they are mechanically correct. This is of great importance to you, Mr. Orchardist.

"New Way" AIR-COOLED ENGINES

will and do give satisfaction. Ask any user. They are built like an automobile engine, with short, straight push rods operating removable valves. There is no packing. They are simple, easy running and powerful.

WRITE FOR CATALOG BF.

John Deere Plow Co.

PORTLAND, OREGON

Spokane, Washington

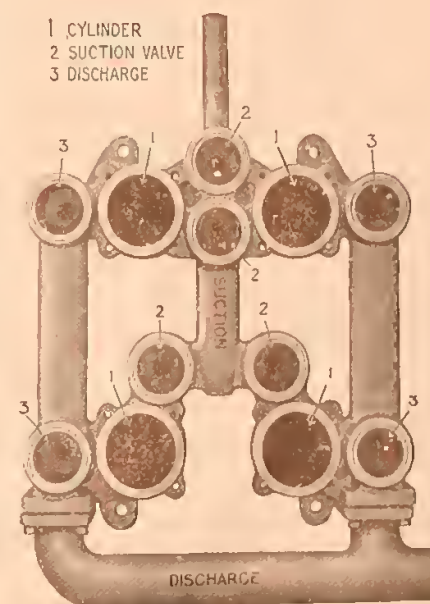
Boise, Idaho

Seattle, Washington

No. 4 RAPID WATERWAYS. No. 2 Rapid Pump has same construction adapted to two cylinders.

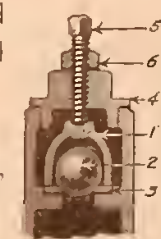
This shows the waterways detached from cylinders and balance of pump; the channels are large and straight, without pockets—in case of necessity they can be removed and replaced in a few moments.

This is the most compact and strongest construction possible and permits making repairs and adjustments more easily and cheaply than any other.



RAPID VALVES. Rapid valves can be taken apart and cleaned in a moment's time.

1. Valve edge rests on valve seat (3) and is held in place by adjusting screw (5), giving the ball proper space in which to operate.
2. Brass ball.
3. Removable brass seat, which is reversible, either side being used; packed with lead gasket.
4. Valve cap removed without disturbing set-screw (5) and giving quick access to the valve.
6. Lock-nut for set-screw (5).



Rapid Valve

BETTER FRUIT

HOOD RIVER, OREGON

OFFICIAL ORGAN OF
THE NORTHWEST FRUIT GROWERS' ASSOCIATION
A MONTHLY ILLUSTRATED MAGAZINE
PUBLISHED IN THE INTEREST OF MODERN
FRUIT GROWING AND MARKETING
ALL COMMUNICATIONS SHOULD BE ADDRESSED AND
REMITTANCES MADE PAYABLE TO

Better Fruit Publishing Company

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SUBSCRIPTION PRICE:

In the United States, \$1.00 per year in advance
Canada and foreign, including postage, \$1.50

ADVERTISING RATES ON APPLICATION

Entered as second-class matter December 27,
1906, at the Postoffice at Hood River, Oregon,
under Act of Congress of March 3, 1879.

North Pacific Fruit Distributors.—The apple crop produced during the last ten years in the Northwest has been small compared with that of the year 1912. Splendid prices have always been obtained by all fruit districts of the Northwest, and it was a very easy matter to make arrangements with the large apple dealers in the principal cities of the East to handle the crops of the different sections on very satisfactory terms, principally through f.o.b. sales, on consignment or with guarantee advances, all of which proved generally very satisfactory. But the year 1912 brought about a different condition, which had not been anticipated by the apple growers of the Northwest, consequently no plans had been made to meet the situation. A large crop of apples was produced in practically every fruit section throughout the United States during the year 1912. The Northwest in previous years had practically done all its business in the large cities only, from which the surrounding towns were supplied according to their requirements. Growers had devoted practically all of their time to planting, caring for their orchards, controlling the different diseases, and producing high quality fruit. Such work had commanded all of their attention, consequently little attention had been given to the matter of marketing. However, some of the fruit growers, who had been closely identified with the marketing problem, either as managers or directors of the asso-

ciations, or as heads of large shipping concerns, gave serious thought to this problem during the past few years, but the number was comparatively few. Most growers seemed to be imbued with the idea, based on past experience, that the marketing problem would take care of itself. Those who were awake to the situation realized that the time was not ripe for action, consequently little could be accomplished if an effort was made on their part along this line. The only course open was to await results; by that is meant to wait until just such a situation arose as existed during the year 1912. "Better Fruit" has long anticipated and realized just such a situation and to the fullest extent has endeavored to do what could be done in advance. "Better Fruit" realized that the immense crop of apples that was coming on in the Northwest could not be handled by the individual growers. Co-operation would be a necessity, consequently "Better Fruit" editorially has always favored the co-operative plan and the organization of the associations in the different districts. Organization in each district is an absolute necessity. The grower cannot independently market his own crop. He has to devote so much time to the care of his orchard and the harvesting of his crop that he does not have much time to spare to become posted on marketing values during the current year. Co-operation is further necessary for the reason that the dealer wants straight carloads of single varieties or of single grades, or of straight 4 and 4½-tier apples. Growers cannot load cars from their individual orchards in this way, but by combining and shipping through one concern, this concern is enabled to give the dealer just exactly what he wants in carloads of any varieties or any sizes. Organization and co-operation started in Hood River in 1893 and has steadily grown. In nearly every district of the Northwest there is now a good association and also individual firms through which a number of growers co-operate, all doing a successful business. This idea and plan continued in favor with increased strength up to the year 1911. Then a great many growers were disappointed in returns, the result was a split up in the different districts. The organization of small concerns. A great many growers pulled away from organizations or shipping concerns and marketed their fruit independently. We all know the result in 1912. The universal opinion now is that each district should be organized and that they should have mutual co-operation in each district without self-competition. Self-competition through a number of concerns acting independently in a district necessarily means competition at home and competition abroad. Competition abroad means glutting of some markets. This must necessarily occur with several doing business in one district without any harmony of action or knowledge of what other similar concerns are doing. Not only this, but an unnecessary number of marketing concerns means an immense unnecessary expense

in the way of duplicating overhead and fixed expenses in the way of managers, stenographers, telegrams, correspondence, bookkeeping, inspection and various other items too numerous to mention. All such unnecessary expense is simply an enormous waste of money, which all comes out of the fruit grower's pocket, inasmuch as such expenses cannot possibly be added onto the selling price. The selling price must depend on market conditions governed by the law of supply and demand. While the law of supply and demand must necessarily be the chief factor in establishing prices, intelligent distribution of the crop so that all sections will receive their supply of apples in accordance with the demand, means fair prices can be maintained. Without intelligent distribution the supply in some centers will necessarily be too great, in excess of the demand, and consequently low prices prevail. If the excess quantity, instead of being shipped to certain markets, is sent to others which are bare and to new territory, it will eliminate some centers being overcrowded and consequently fair prices will prevail. In this way good prices can be obtained through the entire United States for the output of the entire apple crop. If certain markets are overcrowded and apples sold at unreasonably low prices, it affects the prices of apples in every consuming section of the United States.

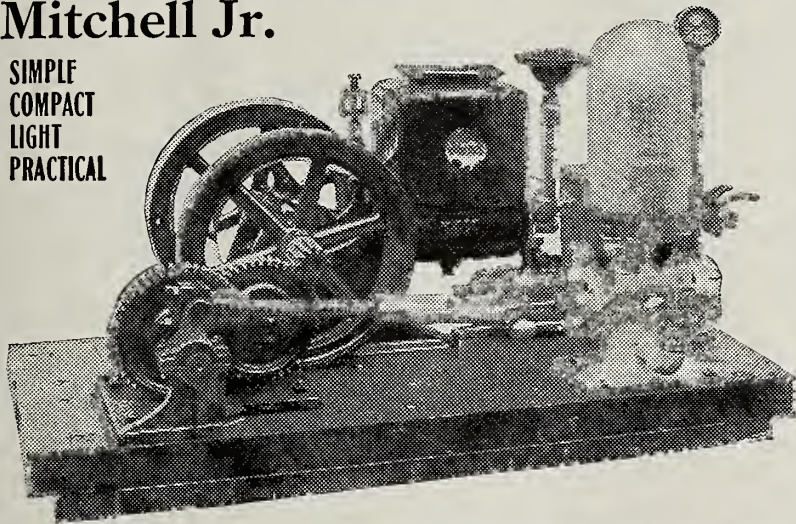
Through Mr. W. S. Clark, of the Wenatchee Fruit Growers' Association, a new plan was adopted this year for marketing the apple crop of the association for 1912. Mr. Clark accepted the presidency of the Wenatchee Fruit Growers' Association and with several directors spent five months in the East early in the season looking over the apple markets, interviewing the trade and studying the situation with a view to intelligently marketing the apple crop of the Wenatchee association for the year 1912. His idea was to eliminate all unnecessary expense. Mr. Clark's opinion was that the apple crop could be handled in a manner similar to the methods used by many large concerns, which place their goods on the market through agents to be sold at a fixed price. Mr. Clark with his directors visited the principal cities of the East and selected twenty through which to distribute the crop of the Wenatchee Fruit Growers' Association for 1912, visiting the trade in each one of these twenty cities, ascertaining the standing of the different fruit dealers, and in each one selecting a representative to handle the association crop, giving that dealer exclusive control. From this representative he ascertained in a definite way as possible in advance how many carloads of Wenatchee apples that particular market could consume during the year. Having this information, he avoided oversupplying this particular market. By the selection of a sufficient number of markets he was enabled to place the entire crop on the plan already outlined. Arrangements were made with different representatives selected to handle apples at ten

The Power Sprayer for Every Grower

Maintains 2 Nozzles Under 200 Pounds Continuous Pressure

Mitchell Jr.

SIMPLE
COMPACT
LIGHT
PRACTICAL



The Pump — The Engine — Base & Jack

A Myers High Pressure Pitman Power Spray Pump with double acting 5 inch stroke. There is nothing better.

A simple one horse Hopper Cooled Stover. Dependable and easy to operate a positive guarantee of ample power

Base is heavy and reinforced with steel girders. Jack is center drive double back geared with machine cut gears.

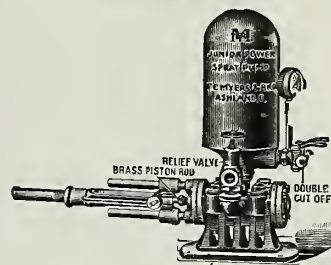
The low price of the outfit will be quoted upon application.

Ask For
Our
Spray Catalogue. It's
Free

Mitchell
LEWIS & STAYER CO.

Implements Vehicles

PORTLAND, ORE.
SPOKANE, WASH.
SEATTLE, WASH.
BOISE, IDAHO



A Good Pump

means better spraying with less work. A good pump lasts longer, hence is really the cheapest. Of course when we speak of good pumps we mean

The Myers

the pump that has always been and always will be good. The kind that never makes you regret the money invested.



If you are
interested,
send for
1913 Spray
Book.



cents per box, thus giving the dealer a fixed profit. Early in December the Wenatchee Fruit Growers' Association had disposed of a certain percentage of the principal varieties in different grades, as shown in the table below. It will be noted that extra fancy Winesaps brought \$1.40, and further that extra fancy, fancy and C grade combined made an average of \$1.30. When this price is compared with some of the prices that were realized by auction by independent growers, it must be admitted that the comparison was very favorable. The plan of Mr. Clark's is entirely a new one and this is the first

year that it has ever been applied to the apple business. Mr. Clark says that inasmuch as this is the first year's experiment on this plan conclusions should not be jumped at. If it works successfully this year it will be entitled to further future consideration. The official association returns reported are as follows:

	Per Cent	Price
<i>Jonathan</i>		
Extra fancy	52	\$1.05
Fancy	26	.60
C grade	22	.60
Average .....		.93
<i>Rome Beauty</i>		
Extra fancy	59	1.10
Fancy	17	.95
C grade	25	.60
Average .....		.97½
<i>Winesaps</i>		
Extra fancy	78	1.40
Fancy	12	1.20
C grade	12	.90
Average		1.30

Spokane was the first city in the Northwest to realize the importance of the fruit industry and to keenly interest itself. Spokane set the ball rolling for the apple industry of the Northwest in a big way in the year 1908 by holding the first National Apple Show on a carload basis that was given anywhere in the world, and has continued to hold this annual apple show each year consecutively for five years. Every one of these apple shows has been a splendid

success. Approximately as high as twenty carloads have been placed on exhibition in an immense building constructed for this purpose. These shows were attended by an immense number of fruit growers from all the different sections of the Northwest. Many of the different sections running special trains carrying several hundred growers to visit the apple show at Spokane. Spokane was wide awake to the situation and realized the marketing condition this year by sending out a special call to the fruit growers in all sections of the Northwest to participate in a general discussion and conference on marketing problems. A large number of prominent growers and association men attended the apple show and took part in this discussion at the morning and afternoon meetings. Several hundred growers were present. The railroads sent traffic managers to attend this conference. Banks sent their presidents and cashiers to take part in the discussion, and business firms depending on the fruit industry also sent representatives. Interest was keen and enthusiasm great, and all agreed that something must be done to solve the marketing problem and the handling of the crop

Continued on page 40

Pedigree Trees

will please you.

It is a Decided Advantage for Fruit Growers

to know for a certainty that the trees they plant are propagated from the best bearing trees in the Northwest.

Write for CATALOGUE, Selected Trees of Certified Pedigree.

Ballygreen Nurseries

HANFORD, WASHINGTON

Methods of Combating Diseases and Insect Pests Infesting the Orchards	Spraying for the Year	Appearance of Insect or Disease	Orchard Practice with Spraying	Kind of Sprays Used	Time to Do the Spraying	Notes
By W. H. LAWRENCE Plant Pathologist and Fruit Inspector Hood River County Oregon	FALL: Anthracnose	Oval, depressed, dead areas in the bark on the trunk and limbs.	Cut out badly diseased and dead branches.	Use 1-1-50 Bordeaux mixture before the fruit is gathered, or 6-4-50 Bordeaux of lime-sulphur (winter strength) immediately after fruit is gathered.	Before the fall rains begin. When the diseases are abundant two applications three weeks apart should be made.	Anthracnose and apple scab fungus both cause disease of the fruit held in storage. Spraying the fruit before picking apparently controls the disease in the orchard and prevents the spread of the fungi in stored fruit.
	Apple scab (fungus)	Dark olive green, nearly circular spots on the leaves and fruit. Often rather indistinct on the leaf, but large and distinct on the fruit.	Destroy diseased and fallen leaves by burning or cover them up by plowing.	Lime-sulphur (winter strength)	After the leaves have fallen.	Every portion of the plant must be coated, even the smallest twigs.
	San Jose scale	Round, gray to black, button-shaped bodies with a pile-like elevation at center, about the size of a pinhead, usually surrounded by a red ring.	Cut down and burn all infested plants of no economic value.	Lime-sulphur (winter strength)	While the leaves are falling.	Spray thoroughly and with plenty of pressure to drive spray among the hairs on stems and buds.
	Pear leaf blister mite	A minute spider living in galls in the leaf of the pear.	Spread from light infection. Stopped by pruning and burning infested twigs.			
	LATE WINTER: "Annual House Cleaning," Powdery mildew	Show as minute round bodies on felt-like growth on young twigs. Spiders are minute, green, and form minute webs on back of leaves, which collect dust, or spiders, shown as a yellow powder under flakes of bark, etc.	Prune the trees, removing all dead and diseased parts of tree. Clean out all wounds and scrape the flakes of bark from trunks of all trees. Burn the rubbish at once. This work should precede spraying.	Lime-sulphur (winter strength)	Do the spraying as the buds begin to open.	Removing all diseased and dead parts and scraping the flakes off from the trunk and larger branches, exposing all hibernating pests so that the spray will reach them, should be practiced. Every portion of the plant must be coated, even the smallest twigs.
	Red spider	A large number of red but minute eggs on fruit buds and spurs.				
	Brown mite	Codling moth is the adult of the codling moth worm, so familiar to all apple growers.				
	Codling moth	Lives in wounds on the trunks of trees and conspicuous because of the covering of white wool.	Remove all rubbish and prunings and burn them at once.			
	Woolly aphid	Small black eggs on current year's growth.		Bordeaux 6-4-50.	Apply the spray before the buds begin to swell.	This method is only effective where sufficient rain to wash off the spray does not occur between the dates of spraying and the following at which time the usual spraying should be done. Spraying should be done as late as possible before buds begin to swell.
	Aphis—Eggs of green and brown	Leaves become thick, leathery, and draw up as if strung on a puckering string.		Bordeaux 1-1-50 or Lime-sulphur 1-32.	Apply while the terminal buds of flower clusters are opening.	Bordeaux gives the better results, but only controls the fungus.
SPRING: Apple scab (fungus) Leaf hopper Thrips Red spider Brown mite Aphides—Green, brown, black and woolly Codling moth Pear and cherry slug SUMMER: Codling moth Apple scab San Jose scale Red spider and leaf hopper Powdery mildew	Apple scab (fungus)	Light yellow, about 1/4 inch long, on under side of leaf, causes nearly white spots in leaf.	Band the trees with tanglefoot.	Black Leaf 40-1 gallon, whale oil soap 40 lbs., water 1000 gallons. (2) Black Leaf 40-1 gallon, lime-sulphur 32 gallons, water 1000 gallons.	Follow the calyx spray for the codling moth. Follows application of Bordeaux, but cannot be mixed with it. (2) Before the flower buds open.	High pressure and a driving spray are required to thoroughly wet every portion of the plant. Careful work in applying the spray is the only practice that will give the desired results. (2) Controls both apple scab and insect pests.
	Leaf hopper	Minute yellowish insects.		Arsenate of lead 1-50 or 2-50.	Before the calyx closes.	Lime-sulphur 1-32 and arsenate of lead 2-50 may be mixed; controls both scab and codling moth. This is the most important of the sprays for codling moth. Use a driving spray nozzle. If the trees are drenched the weaker spray may be used, otherwise use more poison.
	Thrips					
	Red spider					
	Brown mite					
	Aphides—Green, brown, black and woolly					
	Codling moth					
	Pear and cherry slug	A 20-legged, slimy, olive colored slug, which eats out irregular shaped patches in the leaf, leaving the lower epidermis intact.	Remove bands to catch codling worms and destroy the worms.		When the pest appears.	Spray the upper side of the leaves. This is the easiest of all pests to kill.
	Codling moth					
	Apple scab					
Make a study of each fungus or insect that is causing you trouble in the orchard.	San Jose scale				(1) Spray June 1-10. (2) Spray August 1-10.	The June spraying may be omitted under the most favorable conditions, but is recommended since the application is the cheapest form of insurance. Use a good pattern mist spray nozzle.
	Red spider and leaf hopper				After the apples become smooth. As soon as insects appear and before web becomes too thick (red spider), or adults become winged (hopper)	May be omitted if infection is light and weather dry. Russeting of fruit from spray may follow.
Fungus diseases are prevented by coating the plant to keep the parasite from getting a foothold. Diseased plants cannot be cured, since the parasites are internal.	Powdery mildew	Forms powdery white growth on leaves and the twigs, arresting terminal growth.				Spray lower sides of the leaves. Requires a high pressure and very careful work. Wet every leaf.
						Thorough spraying and usually two or three applications necessary where disease is abundant.

Facts Concerning Spraying

Fungus diseases are prevented by coating the plant to keep the parasite from getting a foothold. Diseased plants cannot be cured, since the parasites are internal.

Insects either chew and swallow their food or suck out the juices of the plant. Stomach poisons will kill those that eat parts of plants, but contact sprays must be used to kill those that live on the juices of the plants.

Only parts of plants coated with spray are protected from fungous diseases and chewing insects. Contact sprays are only effective when they come in contact with an insect.

Use plenty of spray, and apply the same with good pressure, driving the solution behind the buds and into every crevice and angle of the tree. Be sure to use the right kind of spray.

Use 8 or 10-foot spray rods and an elbow coupling to set the nozzle at an angle of 45 degrees.

Be sure to do the spraying at the right time.

Do not spray unless you know the reason for doing the work.

Make a study of each fungus or insect that is causing you trouble in the orchard.

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On account of the thorough combination of the arsenic with the lead resulting in a practically insoluble compound, there is no danger of tree poisoning. The excess arsenic in acid brands is usually washed from the tree into the soil causing arsenical poisoning of the tree.

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Due to the thorough combination of the acid with the lead, S-W New Process Arsenate of Lead will not disintegrate when exposed to the atmosphere, thus burning the foliage and injuring the fruit.

Adhesiveness

S-W New Process Arsenate of Lead will adhere to the fruit and foliage and remain in a poisonous condition for the longest possible

time. This is brought about through the large percentage of lead present in this product.

Covering Capacity

S-W New Process Arsenate of Lead will give a thorough, far-reaching and uniform distribution over the leaf and fruit, insuring most effective and economical results.

Quality and Price

Many brands can be purchased for less money than can Sherwin-Williams New Process Arsenate of Lead, but a few cents difference in first cost will be more than offset by the better results obtained. The spraying operation represents a large part of the total expense, and is the same whether a good or poor spray is used. Be sure to obtain maximum results by using Sherwin-Williams New Process Arsenate of Lead.



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"EARLIEST OF ALL" Potatoes planted in March by W. Oldenberg matured June 1st; ninety lbs. of seed gave 65 Sacks, A. B. Crane, Wenatchee, 48 sacks from 1 sack, A. N. Johnson, Spokane, 300 Sacks from 8 Sacks, all shapely, salable potatoes.

Fully Matured in 12 Wks.

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THIS IS THE YEAR TO PLANT POTATOES—market is low—blight has discouraged many growers, and plantings will not be as heavy. This means **better prices next year.**

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Scalecide will not injure you, your pump or equipment, but **SPREADS AND PENETRATES** and even an **INEXPERIENCED MAN CAN SPRAY EFFECTIVELY**

SCALECIDE is the best of the "MISCIBLE OIL" Sprays, and is combined with a **Powerful Fungicide** that eradicates all fungus that can be controlled in the dormant season. **MIXES** instantly and stays mixed. **APPLES** sprayed with "SCALECIDE" took **ALL FIRST PRIZES** at the Pennsylvania Horticultural Society Meeting; all the first prizes this year and last at the New Jersey Horticultural Society Meeting; a long list of sweepstakes and first prizes at the New England Fruit Show in Boston; also first prizes at the Ohio State Fair, Connecticut State Fair at Hartford, and Pomological Society Meeting at Berlin, Conn., and gold medal was awarded "SCALECIDE" at the National Horticultural Congress, Council Bluffs, Iowa.

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is a complete interesting and valuable book on Sprays and Sprayers, and tells all about **GOULDS SPRAY PUMPS**. The most efficient, most lasting, best built spray pumps for every purpose. We will mail this beautiful and useful Book to you **FREE** on request.

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WHEN WRITING ADVERTISERS MENTION BETTER FRUIT

Continued from page 37

in a more effective manner, in order to take care of and dispose of the increased crop at prices that would be satisfactory and profitable to the fruit grower. While space will not permit giving in detail the full proceedings of this meeting editorially, suffice to say at the present that it resulted in a call for a meeting and conference of growers and other allied industries to be held in Spokane on December 16. This meeting held in Spokane December 16 was attended by two hundred and fifty prominent representatives sent from the different fruit sections of the Northwest and a two days conference was held. Everyone present was interested and enthusiastic over the harmony that prevailed. Not a dissenting or objecting voice was heard. It was universally agreed that something must be done and some plan evolved that would be satisfactory to all the different fruit growing sections that would prove effective in intelligently marketing and distributing the fruit crop of the great Pacific Northwest. After two days' discussion on the marketing problems of the past, present and future, an organization was formed called the Pacific Northwest Fruit Distributors. The articles of incorporation will be filed with the Secretary of State of the State of Washington, which will be printed in pamphlet form and distributed to associations in Oregon, Washington, Montana and Idaho. The association will be a mutual corporation controlled by nine trustees and incorporated under the non-profit making law of Washington. The home office will be in Spokane at 907 Paulsen building. The permanent officers elected Tuesday, December 17, 1912, who by virtue of the state law can hold office only six months, are as follows:

W. T. Clark, Wenatchee, president; J. H. Robbins, North Yakima, vice president; H. C. Sampson, Spokane, secretary; H. F. Davidson, Hood River, treasurer; N. C. Richards, North Yakima, general counsel. The other members of the permanent committee, who now become trustees of the corporation for six months, are as follows: Henry Huber, Walla Walla; W. M. Sackett, Bitter Root; P. J. Neff, Western Oregon; W. N. Yost, Southern Idaho, and W. S. Thornber, Lewiston-Clarkston district.

The Northwest is divided into nine districts and each must have its representative on the board of trustees. The districts, with the scope of their territory, are as follows:

Wenatchee District—Chelan, Ferry, Okanogan, Douglas and Grant Counties.

Yakima District—Yakima, Kittitas, Benton and Franklin Counties.

Hood River District—Hood River and Wasco Counties, in Oregon, and Klickitat and Skamania Counties, in Washington.

Western Oregon District—All of Oregon west of the Cascades.

Walla Walla District—Walla Walla and Columbia Counties, in Washington, and Umatilla, Union, Walla and Baker Counties, in Oregon.

Southern Idaho District—All of Southern Idaho and Malheur County, Oregon.

Lewiston-Clarkston District—Asotin and Garfield Counties and Snake River territory in Whitman County, all in Washington, and Nez Perce, Lewis and Idaho Counties and Latah County south of American Ridge, in Idaho.

Spokane District—All Eastern Washington not previously mentioned and Northern Idaho. Montana District—All Montana.

The general purpose of this corporation will be to provide for the marketing and distributing of the fruit crop of

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to send for his new poultry book. It is the greatest ever printed. Homewritten and home printed. Full of common sense about chicken-raising for profit. Tells a lot of things about incubators and poultry that will show you the quickest path to biggest success. Tells how Johnson started with 65c and built the greatest business of its kind in the world. Tells why more than 400,000

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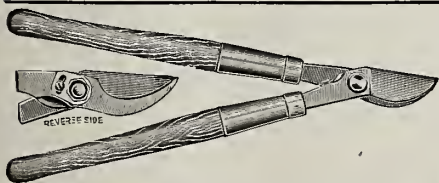
No other machine is made like the Old Trusty: 3 cases—inner case of 1/2 inch powder dry, California redwood. Covered with a casing of fireproof asbestos. Outer casing galvanized metal. Cold rolled copper tank, safety lamp and self regulator. Equipped with egg-tester, trays, Tyco's Thermometer and everything worth having in a machine—price less than \$10. Freight paid E. of Rockies; allowed that far if you live beyond. Address

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the Northwest. The articles of incorporation will give power to employ agencies for the purpose of distribution of the crop and to construct and maintain the necessary property for this purpose, and to employ such help

as may be necessary to handle the business in an intelligent manner.

The following resolution, which was passed early at the conference, in itself expresses the scope and authority:

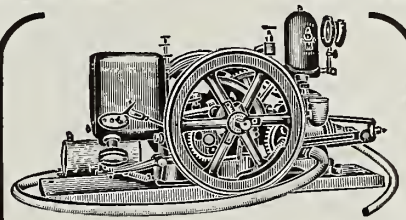
"That such committee be and is given full power and authority to perfect an organization, make articles of incorporation and do everything necessary to complete a corporation or association to act as a general selling and distributing agency for the fruit growers of the Northwest; that when such corporation or association is formed the trustees and officers thereof shall adopt by-laws, plans and rules for carrying out the purposes of such organization and submit the same to the various organizations for the marketing of fruit in the States of Washington, Idaho, Montana and Oregon for their approval, with an invitation to become members of such organization."

While much credit is due to everyone for the keen interest they have taken in this work, it must be remembered that Spokane was the city which took the initiative, and through Mr. H. C. Sampson, the manager of the Spokane Apple Show, arrangements were perfected for these two meetings, which gave him an immense amount of extra correspondence, for which Mr. Sampson is entitled to the full thanks of the fruit growers of the Northwest. Mr. W. S. Clark of Wenatchee, as already stated in this article, has given much time to the marketing problem during the past year without pay, and he, too, was one of the leaders in this movement, which is commanding the attention of every fruit grower of the Northwest. It was a surprise to many to see the interest taken in the fruit industry by the bankers and prominent railroad officials connected with the different railroads over which the great tonnage of fruit of the Northwest passes. Among the railroad officials who took a great interest in this movement, giving much time, should be mentioned Mr. Strahorn, who presided at the conferences of the fruit growers during the entire week at the National Apple Show. Mr. Strahorn also presided at the meeting in Spokane on December 16 as chairman, and appointed a representative from each district to perfect an organization. When railroad men of such prominence as Mr. Strahorn, whose time is so fully taken up in an official way by the big railroads which he represents, leave their business to interest themselves in our business, it must be evident to all that the fruit business is not only an immense and important one to every business of the Northwest, but to the railroad business as well. When bankers attend such meetings it indicates the extent of the fruit industry and its effect on all lines of business. At first it would seem to the casual observer that prices of fruit would only affect the fruit grower, but upon further thought and investigation it must be clear to everyone that the prosperity of all other lines of business in the Northwest depends to a large extent upon the prosperity of the fruit grower. If our fruit cannot be sold at profitable prices throughout the East there is so much tonnage lost by each and every railroad in the Northwest which carries our fruit. If the fruit growers' business is not profitable, it affects the banking business in every fruit section.

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YOU must spray to secure perfect fruit. Use a Fairbanks-Morse high pressure sprayer and do the work quickly and thoroughly. The above 1 H. P. Gasoline Engine Outfit will supply three 1/4-inch Vermoral spray nozzles at 200 lbs. pressure which is the pressure required for effective spraying for scale diseases. The "Deluge" pump gives steady pressure. Entire outfit compact, strong and easily moved about the orchard. Will give splendid service for years.

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Banquet given by the Bean Spray Pump Company to their employees in the new addition to their factory at San Jose, California

In fact, unless the fruit growing business is profitable, every little town in the Northwest where fruit is grown would be affected, and if business in all small cities in all fruit sections is affected through lack of profit in the fruit business, it means that the prosperity of the large cities of the Northwest and the big banks in financial centers of the Northwest will also suffer just as much loss in proportion as the value of the fruit business compares with the entire volume of business, consequently it must be evident that the marketing of our fruit at satisfactory prices will affect every line of business in the Northwest to a greater or less extent sooner or later. This has become evident to the railroads, banks and big business men of the Northwest. In fact, as frequently remarked by many prominent bankers, railroad officials and fruit growers at these conferences, it is true that we are all partners in this business. The railroad, the bank and the business man are dependent on our prosperity, and consequently it is to their interest to assist us to be prosperous and to give us the benefit of their business ability and judgment to help solve the problem in order that we may meet with success, prosperity and reward, which in turn means success and prosperity to them in their business. That the work of the trustees in formulating a plan is a large one is universally admitted and thoroughly understood, consequently the trustees have stated that much time will be required in formulating the preliminary plan which is to be submitted to the different fruit growing sections for their approval or suggestion. It is the intention of the trustees to meet from time to time in each of the prominent fruit sections in order to better understand the conditions and requirements

of all localities, consequently the first meeting will be held in Yakima on January 3. While the trustees at the present time have nothing to give to the public in the way of a plan that is definite, it is stated that in ninety days they expect to make a report of such progress as may be achieved at that time. While the editor of "Better Fruit" was present at the conference at Spokane during the National Apple Show, it was with sincere regret that he was unable to attend the conference December 16, being confined to his home with an attack of la grippe, however a number of people who were present at the meeting have been thoroughly interviewed, consequently this editorial conveys pretty thorough knowledge and information of the procedure up to the present time. "Better Fruit" desires to impress upon fruit growers the importance of working out plants by which our fruit can be intelligently marketed

and properly distributed, so that prices may prove satisfactory and the business continue to be profitable in the future as well as in the past. While all of this is necessary, it must be remembered that it is just as important now, and even more so, to care for our orchards, keep them free from diseases, properly pack and grade our fruit, because without the same keen interest and attention that we have devoted to these matters in the past we cannot produce the quality of fruit that will command the price, no matter how perfect our system of marketing may be. "Better Fruit" will therefore continue as in the past to give the fruit grower the benefit of all information about care, culture, treatment of diseases and packing, and in addition it will be the intention of "Better Fruit" to devote much time and space to the marketing problem and to keep the subscriber and the fruit grower fully posted, giving all information that will be of value or of interest on the marketing of fruit. Each number will contain the latest information up to date about the procedure, action and plans of the trustees of the North Pacific Fruit Distributors.

WAGNER'S GIANT WINTER RHUBARBS MUCH MORE PRODUCTIVE THAN THE COMMON CRIMSON WINTER

So says Mr. J. B. Wagner (rhubarb specialist) of Pasadena, California. Mr. Wagner states that the Giant Winter Strains which he is now offering for the first time is a much stronger and much more rapid grower than the Common Crimson varieties. The Giant Winter Strains come soon after planting, and unless the ground is frozen it keeps growing constantly. Giant Winter Strains stems proving twice as large as the ordinary old-time Crimson Winter, being hardy in any climate, will grow and yield handsome returns where the Crimson Winter varieties would be a failure. Mr. Wagner states that his Giant Winter Strains are unsurpassed in either flavor, texture, size or hardness and that the price he is offering them to the public is the same as the Common Crimson Winter, yielding much heavier than the old-time sorts and is much more profitable.

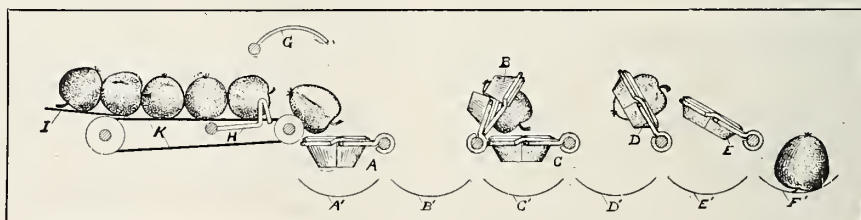
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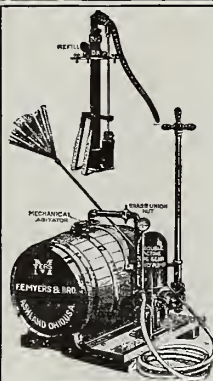
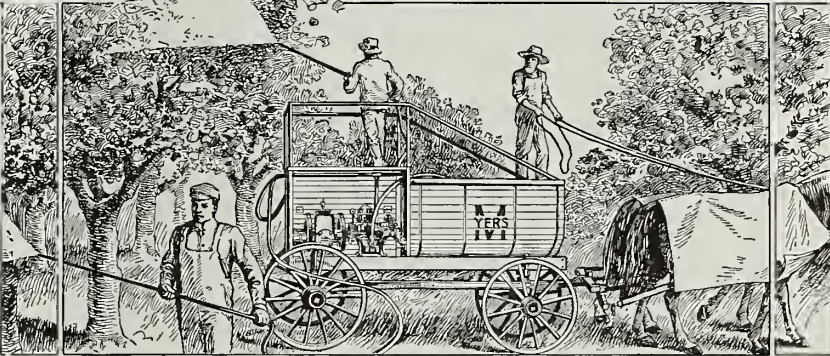
Continued from page 30

attention. There are very few really poor sites for strawberry growing in the Kootenay, with perhaps the exception of those very light soils and those located too low, where the rise and fall of the water would affect them. Strawberries do best on a good, heavy silty to clay loam soil which contains a good supply of humus or vegetable matter. They must have a well-drained soil. This last remark led a great many in the earlier days to suppose that strawberries would do best on an open sandy soil, but time has demonstrated that so long as the soil is well drained the heavier soils will yield the best and heaviest crops of berries. The preparation of the land before planting is a point upon which a great deal of the success or failure depends. In the Kootenay the newly-cleared land should be worked a year or two and enriched by the plowing under of green crops, preferably a leguminous crop, or an application of barnyard manure before setting out to strawberries. Poultry manure is one of the very best fertilizers for strawberries. Another important point in the preparation of the land before setting is to thoroughly level it down; all holes and hollows should be filled in by means of a scraper or split-log drag leveler, as shown in illustration. This implement is easily and quickly made at home and works wonders in leveling uneven sites. If strawberry plants are set on uneven land the growth will be very uneven, resulting in a great many of the plants being either killed out by water settling in the hollows or by the heaving action of the frost.

Spring planting is best. Select the plants from the runners in the bearing patch. Select the plants from the first two plants formed on the new runners. These will be much stronger and better than the third or fourth plants on a runner. Where large numbers of plants are required the planting out of a special propagating bed is advisable. The plants set in the bed are allowed to throw as many runners and set as many new plants as they will. In the spring, when ready to plant, the whole bed is dug up and the best of the plants selected for planting. There is a great scope for selection of the best and most prolific strains of the varieties by marking the best producing plants in the bearing patch and then propagating from these. There is one man who by this practice increased his yield from 8,000 pounds to 16,000 pounds per acre.

The plants are generally planted in what is known as the matted-row system, the plants being set eighteen inches in the row and the rows set three and one-half to four feet apart, depending on the growth of the variety being planted. In new land, weedy land or on poor light soil, the hill system of planting is followed, as it gives better results. In this system the plants are generally set two feet apart in the rows and the rows three feet apart. This system allows far better

IT PAYS TO SPRAY WITH A MYERS SPRAYING OUTFIT



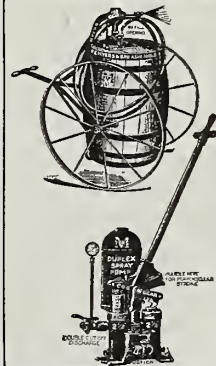
A Myers Spray Pump is an investment that pays and pays well. It does not mean outlay. It means income. It means a more marketable fruit or vegetable crop—one that not only sells more readily but commands a better market price—that shows a greater profit to the grower.

The vast difference in the salability of unsprayed and Myers-Sprayed fruit has caused many orchardists and farmers in this and foreign countries to make the statement, "It pays to spray with a Myers Spraying Outfit."

Myers Spray Pumps are the result of years of experience and experiment. They have been developed with spraying itself, in line with spraying needs, and have withstood the tests made of them for service and reliability. The Myers line includes a pump for every need.

Myers Spray Nozzles and Accessories are complete in every particular and can be relied upon to do the work expected of them. Our Spray Pump Catalogue tells all about them, illustrates and describes the few pumps shown here and the many other styles and sizes of Knapsack, Bucket, Barrel and Power Spray Pumps we manufacture. It also gives valuable spraying information, including a spray calendar, spraying solutions, etc.

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"Black Leaf 40"

SULPHATE OF NICOTINE

"Black Leaf 40" is highly recommended by experiment stations and spraying experts throughout the entire United States.

Owing to the large dilution, neither foliage nor fruit is stained.

Also, "Black Leaf 40" is perfectly soluble in water—no clogging of nozzles.

PRICES:

10½-POUND CAN.....\$12.50

Makes 1,600 to 2,000 gallons for spraying Pear Thrips and Hop Louse, with addition of 2 per cent distillate oil emulsion; or 1,000 gallons for spraying Green and Woolly Aphis, with addition of three or four pounds of any good laundry soap to each 100 gallons water.

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½-POUND CAN......85

These prices prevail at ALL agencies in railroad towns throughout the United States. If you cannot thus obtain "Black Leaf 40," send us post-office money order and we will ship you by express, prepaid.

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LOUISVILLE, KENTUCKY

cultivation and is not as hard on the soil's water supply as is the matted-row system. The patches are allowed to crop two or three years. The third crop should only be taken when the ground is rich and clean. Strawberries are heavy feeders and will leave the ground in a poor condition if grown too long, especially where no manure of a lasting nature is supplied. As the berries are as a general rule grown as an inter-crop in the orchards they should not be allowed to remain too long, as this will affect the growth of the fruit trees. In young orchards strawberries should not be planted closer than four feet from the trees, and this distance should be increased as the trees become older. Great care should be exercised during the first fall in not causing the fruit trees to make late growth by the cultivation which is necessary in the berry patch in order to develop good, strong crowns for the following season's crop. Irrigation is not always needed in the West Kootenay district, but where it is convenient it should be in readiness for the insurance of a good crop. An application of water to the patch just after the first or second picking will often double the yield. Mulching the berries to prevent them from becoming soiled during the picking season is very important if the berries are to be shipped. This is one of the serious problems confronting the growers in some parts of the district where no straw or slough grass is to be obtained locally. In some parts ferns are cut and used to good advantage. Others cut clover and mulch the patches with it, allowing it to remain and be worked into the soil as a fertilizer. This is especially good during the last year of the berry patch which is plowed immediately after the crop is picked.

Another problem which is serious in some parts is the number, cost and quality of the berry pickers. In some parts the Doukaboorers are available and in others Indians are to be had; both of these sources are good when obtainable. On the other hand, where these people are not to be had and the grower has to depend on white labor for the picking he must be cautious in not setting more plants than can be easily handled by himself or family, and possibly the assistance of some of the neighbors. However, it is to be recommended that all the growers with young orchards should endeavor to plant out a small patch of berries, as they are one of the very best crops from which to procure a good revenue until such time as the orchard will bring in some returns. Rather plant a small patch well and give it good care than to attempt anything larger. Do your share of the work well and the climate and soil will do the rest.

Editor Better Fruit:

I read your publication every month and glean from it many items of interest, and think it more than a credit to the editor in getting out such a good and up-to-date publication. I believe that anybody interested in the culture of trees or fruit, especially apples, can hardly get along without it after he has once had it. This seems to be my case. Yours truly, Theo E. Guth, St. Paul, Minnesota.

Larval Form of Canker Worms

Continued from page 32

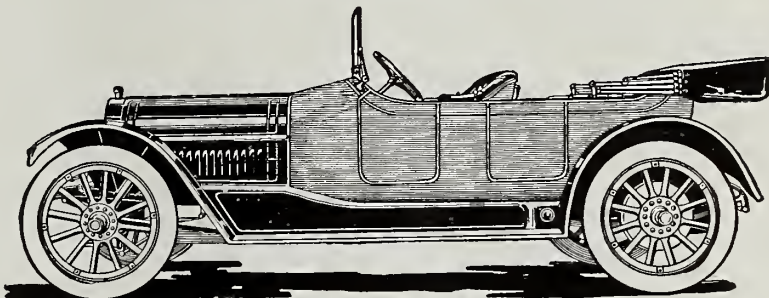
out the season without serious injury. It may also be used on apples and pears in the Coast districts if applied very early (while the trees are in bloom) or if combined with the bordeaux mixture. This arsenate should never be used on stone fruits. Acid arsenate of lead gives quicker results with canker worms than the Ortho compound, and may be used in the Coast district if applied before the trees have gone out of bloom, but any later sprayings will be dangerous unless mixed with bordeaux or iron sulphide. Zinc arsenite is the most powerful arsenical now on the market. It is also more injurious than Ortho arsenate of lead, but under most conditions less injurious than the acid arsenate. This poison was first intended for use against the very resistant tussock moth and other similar caterpillars. However, it appears to be suitable for early codling moth and canker-worm spraying, and quite likely may be substituted for acid arsenate of lead in the dry interior climates. Zinc arsenite should not be combined with bordeaux, but if a fungicide is desired iron sulphide may be used.

Ortho arsenate of lead: Commercial lead Ortho arsenate, 12 pounds; water, 200 gallons. Arsenate of lead is sold as a stiff paste, containing 40 to 50 per cent of water. This paste must be churned up into a smooth mixture in a few gallons of water before pouring into the spray tank. The mixture must be well agitated while spraying and the application should be very thorough, giving special attention to the tops of the trees. Use a coarse driving spray at high pressure and make the trees drip profusely. The first application for canker worms, codling moth, etc., had best be applied before all the blossoms have fallen, and in bad cases another spraying will be advisable two weeks later. The neutral or Ortho arsenate, if true to name, will not cause any foliage injury, no matter how or when applied.

Acid or Pyro arsenate of lead: Commercial acid or pyro arsenate of lead, 12 pounds; bordeaux mixture, 200 gallons. For blossom spraying, water 200 gallons. The bordeaux mixture can be used in this early spraying also, as should be done if there is much danger of apple scab. Mix in the same manner as the Ortho arsenate, apply with equal thoroughness, but do not use on stone fruits. In the Coast districts the earliest application (before all the blossoms have fallen) may be made without bordeaux mixture, but all later sprayings should contain this mixture. Bordeaux is not necessary in the dry interior valleys.

Zinc arsenite: Commercial zinc arsenite, 6 pounds; water, 200 gallons. Apply thoroughly before all the blossoms have fallen. Do not mix with bordeaux, but if a fungicide is desired use iron sulphide. Do not use on stone fruits, and for all applications after the blossom spraying cut the zinc arsenite down to one pound to one hundred gal-

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These are great advantages. The electric lights are tremendously powerful; show up every bad spot in the road for five hundred feet ahead. Battery kept charged by generator. The electric self-starter saves all the labor and annoyance of cranking the engine, and adds greatly to your comfort and safety, keeps you out of the cold, wet and mud, and makes it possible for the women and boys to start the motor and drive the car.

All Mitchells, like most of the very high-priced cars for 1913, have the new long stroke, T-head motor; the newest thing for increased power and high efficiency.

Powerful—all the horse-power claimed for them. Simple—you and your boys will easily understand the entire "works" very quickly. Economical—they don't cost much to run. Handsome—nothing has been spared that would add to their appearance.

There's nothing too good to be used in the Mitchell; it has all the new improvements, every one of them. Also the same high-grade workmanship and material that have gone into Mitchell vehicles throughout the past 78 years.

You won't find any other medium-priced car that offers anything like the advantages of the Mitchell—a \$5,000 car in the \$1,600 class. You can't beat it at any price. You can't equal it at anything like the price.

All with T-head motor and 36-inch wheels.

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7 passenger Six	60 H.P.	144 inches	4 1/4 x 7 inches	\$2,650.00
2 or 5 passenger Six	50 H.P.	132 inches	4 x 6 inches	2,000.00
2 or 5 passenger Four	40 H.P.	120 inches	4 1/4 x 7 inches	1,600.00

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Guaranteed to test 30° Beaume or better and to contain no adulterants.
Made of the purest materials obtainable and by scientific methods.

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lons, or two pounds to the tank. Apply very thoroughly, especially if it is desired to kill tussock caterpillars.

Which of the above formulas will prove best depends on circumstances. Ortho arsenate of lead is the safest and will give good results when properly handled. The canker worms do not die at once, but soon cease feeding and they will be materially reduced in a week. If the tussock caterpillar, or the caterpillar known as "green worm," are present it is evident that the zinc arsenite early application will have a useful and double effect. Spraying with zinc arsenite is to be recommended, provided it is understood that the strong application is not to be used after the trees are in full foliage. Acid arsenate of lead may be regarded as a material to be substituted for the Ortho compound in cases of very bad attacks of canker worms that have been neglected until quick control is necessary. The acid arsenate can then be applied in combination with the bordeaux mixture or with iron sulphide to counteract the injurious action on the foliage. When canker worms are to be controlled on stone fruits, such as peaches, apricots, prunes, etc., only the Ortho arsenate should be used.

In all cases where bordeaux mixture is combined with arsenate of lead it must be prepared in the usual way. That is, the bluestone solution neutralized with lime before the arsenate of lead is added. Several serious cases of foliage and fruit burning have resulted

from the use of bluestone, and arsenate of lead without lime. Do not spray Bellflowers with the bordeaux mixture unless there is much danger of scab. Bordeaux is very likely to russet this apple and so should not be used except in cases of necessity.

THE KIMBALL CULTIVATOR

The Kimball Cultivator is made in nine sizes, which enables us to give anyone the size that is necessary to do his work, whether he needs the four and one-half-foot size for the small farm or the seventeen-foot size for the large summer fallow fields.

The seventeen-foot gang cultivator is a combination of an eight and one-half-foot section, eleven baldes, and a nine-foot section with twelve blades, coupled together in the same manner as a two-section harrow, with the joint in the middle, which enables it to follow the uneven ground. We have found this a fine tool to work the summer fallow where the old stubble is well plowed under; but it will not work with the old stubble on top of the ground, as nothing will cut the old dry straw.

We recommend the eight and one-half-foot size in most cases, as it is the best size for two horses, and better work can be done with it than with other sizes.

The twelve-foot open center is an excellent size for what it is intended to do—to cultivate up close to the trees where they are headed down low—the horses being far enough away so they do not rub the limbs or fruit. Two horses pull this one very nicely. These machines are of simple construction and easy to operate and guide. A boy can manage them as well as a man. The frames are made of the best selected Douglas fir, painted with two coats of red lead and oil. The blades are of the highest carbon spring steel made. They are rolled concave on the upper side and straight on the lower, which makes them practically self-sharpening. Being of such hard and tough metal, they retain their cutting edge for a long time. The peculiar turn of the blade is such that there is no wear on it, and it does not weaken in the turn and spring out

of shape, as most cultivators of this kind do. This is one of the patented features.

Each size is provided with fenders on both ends, which prevent striking trees with the knives and allows such close work that hoeing around trees is unnecessary where the KIMBALL is used. Either one or two horses will draw the five and one-half-foot cut, while two horses will operate the eight and one-half-foot or twelve-foot extension with ease all day and cultivate thoroughly from eight to ten acres within ten hours.

In using this implement, the driver stands in the center of the board over the knives, and to guide it will step from left to right as the occasion requires. If anything should catch or gather on the knives the driver steps forward on the draft board, tilts the handle forward, which raises the knives and frees anything that may have gathered on them. Keep all the nuts tight, and should any of the

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knives become bent out of shape force them back without removing them from the frame. A heavy scantling may be used to spring them back to position. Should the machine run too deep in soft ground the difficulty can be overcome by bolting a short piece of 2x4 scantling under each end; slant the ends of the scantlings up in the manner of a sled runner. These things are unnecessary unless the ground is very soft.

RETAIL PRICE SCHEDULE

No. 4—4½ feet, 6 blades, weight complete 70 pounds.....	\$13.50
No. 5—5½ feet 7 blades, weight complete 85 pounds.....	15.00
No. 6—6 feet, 8 blades, weight complete 100 pounds.....	17.50
No. 7—7 feet, 9 blades, weight complete 100 pounds.....	18.50
No. 8—8½ feet, 11 blades, weight complete 115 pounds.....	20.00
No. 9—100 feet, 13 blades, weight complete 140 pounds.....	25.00
No. 10—12 feet, 10 blades, open center, weight complete 160 pounds.....	22.50
No. 11—12 feet, 15 blades, weight complete 185 pounds.....	30.00
No. 13—One 8½ and one 9 feet, 23 blades, gangs, fully rigged, 300 pounds	47.50

Extra frames \$1.00 per foot; weight 10 pounds per foot. Extra blades \$1.50 each; weight 5 pounds each. Terms, cash with order, except to dealers with established credit. All quotations f.o.b. The Dalles, Oregon. The cost of Kimball Cultivators can be ascertained by asking your local freight agent for rates from Portland, Oregon, to your station.

[Advertisement]

STARK BRO'S NURSERIES & ORCHARDS CO.

Louisiana, Missouri, November, 1912.

Editor Better Fruit:

We desire to thank you for your appreciative remarks in regard to our "Stark Orchard Book" and the other booklets we have issued from time to time. Will be glad to have you look over the book and let us have the benefit of your further comments. We have read, with interest, the October issue of "Better Fruit" and desire to say that we find you are carrying out a policy which we deem very important to nursery business in particular and fruit growing in general, namely, the education of the general public as to the food value of various fruits. The idea, of course, is not new, but you are handling the matter in a practical way; you are blazing the trail that others should follow—must follow—if fruit growing is to be what we believe it will be—one of the greatest industries of the nation. Your article, "Two Hundred and Nine Ways of Serving the Apple," is strictly along this line. All nurserymen, in fact all fruit interests, should co-operate and work together to educate the public; this is one important way of reducing the present high cost of living. People can be educated in this country to use more fruit products as staple foods, just as they have been forced to do in Europe and other countries of the Old World, where they eat more fruit and vegetable products and less meat, with the result that they are greatly benefited financially and their health is immeasurably better. The consumption of more and better fruit by us as a nation is bound to increase our physical strength and health.

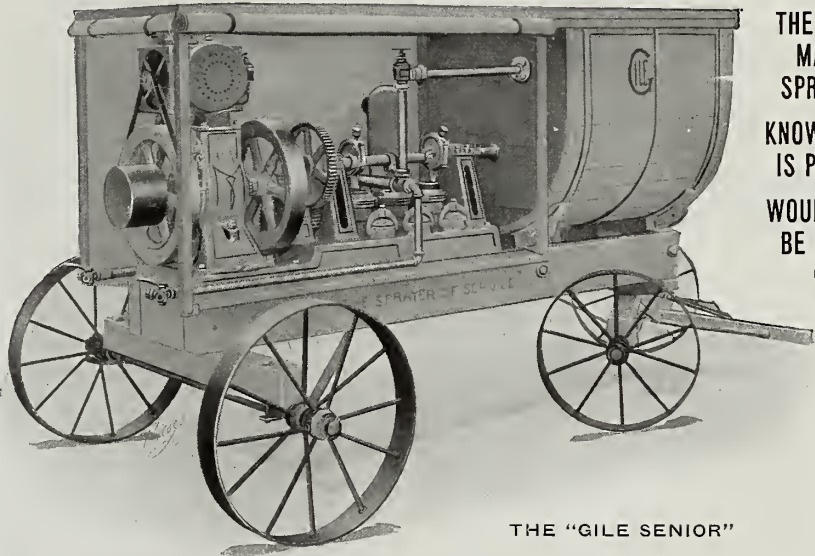
In the writer's travels in the various countries, we have always been struck by the exceedingly small quantity of meat included in the menu of the so-called middle classes as compared with the enormous amount of meat consumed by citizens of this country. The point is just this: When we can educate the American people to consider fruit not as a luxury, but as an absolute necessity, then we have arrived at the one solution of the present high cost of living—we have benefited the citizenship of the nation, a good per cent of the meat bills will be reduced and last, but not least, the dreaded doctor's bill will largely be forgotten.

The writer now has in preparation a paper entitled "The Future of the Nursery Business," which is to be delivered at the Kansas City meeting of the Western Nurserymen's Association, and we expect to incorporate the above mentioned ideas in this paper. Certainly this is one way to better the future of the nursery business, the fruit industry and the nation. We wish you all success in the great work you are doing and desire to congratulate you on the practical manner in which you are handling this more or less theoretical matter. With best wishes, we remain yours very truly, L. C. Stark.

Editor Better Fruit:

Enclosed find my check for one dollar in payment for "Better Fruit" for one year. Your publication is by far the best of its kind I ever saw and entitled to the fullest support. Your truly, S. D. Pulford, Myrtle Point.

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The wise man carefully studies the question of sprayers and spraying and buys the best machine he can get—not the best for the price he pays—but the best machine on the market, and in the end this always proves the most economical and satisfactory purchase. It's mighty poor policy to invest in a machine which looks good until it begins to work—and then you discover that it is as cheaply constructed as the price. We have made a long and thorough study of spraying and sprayers, and as a result present to the fruit growing public a sprayer which more than fills all requirements, is as near absolute perfection as high grade material, superior design, and skilled labor can produce, and fully guaranteed in every way. We are ready and willing to place our sprayer in any orchard beside any other sprayer manufactured and leave the decision to the purchaser.

Our rigs are delivered complete, ready to SPRAY, except whippletrees and neckyoke. All engine and pump parts are interchangeable, which reduces repair expense to a minimum. Engines may be removed from sprayers by unloosening four bolts and sliding engine out of mesh with gears. This may be removed and replaced in a very few moments. This combines all the features of a high grade farm engine with the sprayer. We'll be glad to go into details with you—drop us a card today and start the New Year right with a resolve to increase your profits, then put your resolve into practice by ordering a GILE SPRAYER. We have sprayers in two sizes—GILE SENIOR and GILE JUNIOR, also Stationary Farm Engines, Pump Jack Engines and Electric Lighting Plants. Write for literature today—you can't afford to miss the opportunity of making 1913 your banner profit making year.

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Will not only light every room in your home and outbuildings, but will operate your feed chopper, washing machine, sewing machine, grindstone, cream separator, or in fact anything that uses electricity for power. You can install the "Homelite" plant yourself.

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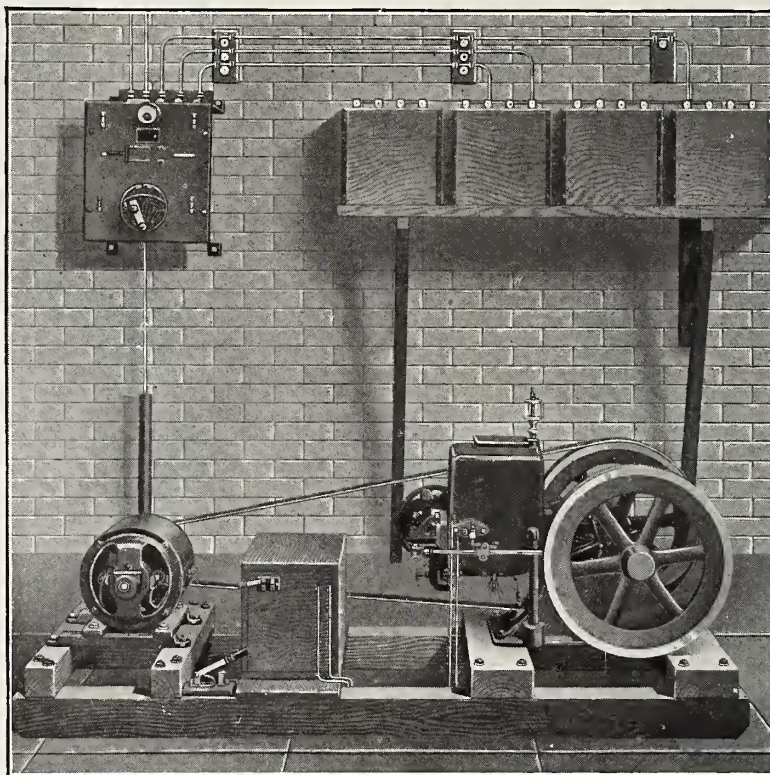
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Winter Control of Orchard Pests

Continued from page 20

This type is now quite popular. The Cyclone nozzles throw a hollow cone of spray. In the long-distance Bean nozzle this cone is narrow and so carries well for several feet, an important feature. In general, the essential feature of a nozzle is the ability to deliver a large volume of well-divided spray which will quickly drench the tree. In order to accomplish this the apertures must not be too small. High pressure makes it possible to obtain a well-divided spray from large apertures. While the power outfit has the greatest field of usefulness there is still much room for hand pumps. The cost of power machines is often too great for small growers and the use of heavy outfits may not be practicable on hill-sides. The principal difficulties with the hand outfits is the great labor required to operate them at satisfactory pressures and the poor agitation, because the man forgets to stir the barrel. In the Bean Magic Pump the difficulty of maintaining a good pressure is largely overcome by the intervention of a spring which equalizes the work between the up and down stroke of the piston. This pump compares favorably with power outfits as regards the quality of the work, but, of course, is of less capacity.

The same contention can be made for winter spraying as for summer applications; that is, that the work should

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160 acres near The Dalles, Oregon, 6 miles from town, on county road. All under fence; partly improved; schoolhouse 1/4 mile from house; 5 springs; 35 acres in cultivation, 100 acres tillable land, rest pasture. Good 6-room house, 2 barns, 3 chicken houses, 2 hoghouses, 2 cellars; 2 acres chicken-tight, 5 acres hog-tight fenced; 4 acres bearing orchard, 6 acres of young orchard; 45 acres of the very best fruit land when cleared. Fruit is of the highest quality and unsurpassed in color. Three acres in alfalfa. Good team, 2 cows, brood sow and boar, 100 chickens. Studebaker wagon, light wagon, buggy; all farm machinery and tools.

Price \$60 per acre. Terms, one-half cash, balance on 6 per cent.

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It isn't what we claim, but what users say, that we wish you would investigate when you are planning on making more money from your cows. Ask us to send you our FREE Catalog S 28.

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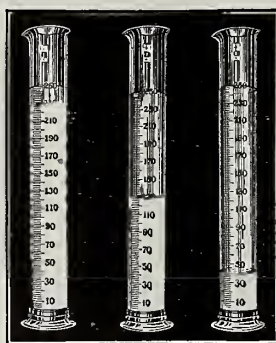
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be thorough. It is not an easy matter to completely spray a tree, but it can be done, especially if intelligent men are employed and a system is followed. In spraying a tree always begin with the top and hold the nozzles high in the air until this portion has been thoroughly drenched. The lower branches and trunk can then be quickly finished, as they have already received much in the way of drippings from the top.

The San Jose scale insect is quite well known to most orchardists. When abundant it produces a scurfy condition of the bark, more or less gray in color. This has been very aptly described by some as an appearance like ashes had been thrown against the tree and adhered there. When this scurfy covering is carefully removed with a knife small, bright yellow specks will be found under it. These specks are the bodies of the scale (different from the Italian pear scale, which have red bodies). After finding the yellow bodies, which prove the presence of live scale, cut into the bark. A red stain will be found either in small patches or quite generally over the limb. The red stain will often appear even when a very few scale are present, and affords the best means of identification. The fruit may also be infested with scale, and frequently the best means of detecting the insect in apple orchards is by examining the apples at the time of picking. There may be some confusion here, however, as a red spot of unknown origin is sometimes present. When the red spots are caused by the San Jose scale the insect can always be found in the center of some of them. All these observations can be made with the unaided eye, but a small magnifier will be a great help. The San Jose scale sucks the juices from the inner bark and does not eat the surface. It stunts the growth and may even cause the death of limbs, and perhaps the whole top. This injury is due to the injection of a toxic substance into the tissue of the bark. Fortunately trees will recover from this injury, even when far advanced, if the scale is killed.

The lime-sulphur solution is now conceded to be the best remedy for the San Jose scale. Spray the orchard some time during the winter with lime-sulphur solution (any time between the falling of the leaves and the opening of the blossoms). The commercial solution of standard strength (33 to 34 degrees Baume) should be used not weaker than one part of the solution to nine parts of water. The home-made solution should be used as per formula given in this article. Choose a period of dry weather for spraying. Best results are obtained when there is a week or more of dry weather after the application. The lime-sulphur solution acts slowly and scale may continue to die for a month or six weeks after the application. The work should be done very thoroughly. Aside from unfavorable weather conditions lack of thoroughness has been found to be the most fruitful source of failure. It is not suf-



CORONA DRY REGULAR PASTE REGULAR DRY
(Not Corona Products)

Above test shows suspension after standing five minutes. This proves Corona Dry Powdered Arsenate of Lead lighter and softer than either paste or other dry arsenates of lead.

NOT a new formula, but a marvelous, patent-applied-for process which makes a dry powdered Arsenate of Lead that is as soft as cotton and as fine as flour.

Corona Dry Powdered Arsenate of Lead contains nothing but *lead oxide* and *arsenic oxide*—the only two essentials of any arsenate of lead. The superiority of this insecticide over all other arsenates of lead—dry or paste—is due to the improved process of manufacture, and to that alone.

Corona Dry Powdered Arsenate of Lead, being lighter, finer and fluffier, stays mixed longer without settling, has better spraying qualities and adheres longer to the foliage, fruit and branches. One pound of Corona Dry Powdered Arsenate of Lead will cover more surface and kill more pests than two to three pounds of paste arsenate of lead. Use only one or one and a half pounds to fifty gallons of water or fungicide.

It mixes quickly and easily in water—no sediment—no lumps—no

A New Chemical and Scientific Discovery of Amazing Value to All Fruts Growers

A Spray Compound Which Has Been Thoroughly Tested, and Proven to Have the Highest Percentage of Actual Killing Power

waste—never clogs spray nozzles. *The pest killer to depend on.*

Never before has there been a satisfactory dry powdered arsenate of lead. The old-fashioned acetate or nitrate precipitating processes give a heavy, coarse substance which quickly settles in the spray tank, making impossible a uniform strength of spray. Our new process overcomes all this.

Furthermore, Corona Dry Powdered Arsenate of Lead is most simple, clean and easy to handle. It cannot freeze, dry out, cake or lose its strength. It combines convenience, economy and efficiency. It is the great ORCHARD SAVER.

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ficient to cover the limbs with a fine mist-like deposit, but the tree must be drenched with the wash to insure contact with every portion of the bark surface.

The greedy scale, sometimes called the willow scale, is found on a great variety of trees and shrubs. It is seldom abundant enough to injure trees, but may cause some of the leaves to hang over winter on badly infested pears. Dwarfed growth and die-back of apples have in certain cases been attributed to this scale. The insect is larger than the San Jose scale and more elevated in structure. Upon removal of the scale the body is seen to be yellow, but averaging considerably larger than the San Jose scale. The insects are seldom located so close together as to form a continuous crust, but at times may be found in this condition. The scale is usually found around the buds and upon the small twigs. No red stain is produced in the wood. The fruit is frequently infested in both apples and pears. The scales here vary from extremely small to the largest size and are often located about the blossom end. The presence of the greedy scale upon the fruit is the principal cause of annoyance from this insect, as there is danger of rejection in some markets.

It is difficult to clean up trees infested with the greedy scale and no treatment has as yet proved perfect. We have reduced the scaly fruit from seventy-five per cent to fifteen per cent by two applications of lime-sulphur solution, and from ten per cent to one per cent by the very thorough application of a six per cent distillate emulsion. General orchard practice shows that lime-sulphur solution as applied for the San Jose scale reduces the numbers of the greedy scale, but not so completely as in the case of the first mentioned insect. For the greedy scale make two thorough applications of lime-sulphur solution, preferably the first just after the leaves have fallen and the second shortly before the buds open in the spring. Or use distillate emulsion at from six to eight per cent some time during the winter, but preferably just before the buds open. The application should be very thorough and directed especially at the small twigs where the scale is mostly located. The use of strong distillate emulsion or mechanically-mixed oil is not unattended by danger to the trees. Care should be taken to see that the root crown is not injured. If much wash runs down the trunk the wet earth should be removed shortly after the application. Properly sprayed trees will have a greasy appearance for several hours after the application. The oil may have the effect of reducing the amount of the first foliage, but the fruit crop will probably not be injured.

The Oyster-Shell Scale.—The adult female of this species is covered by a dark-colored, long tapering scale which is curved near the small end. These scales are often found quite abundantly upon the trunk and large

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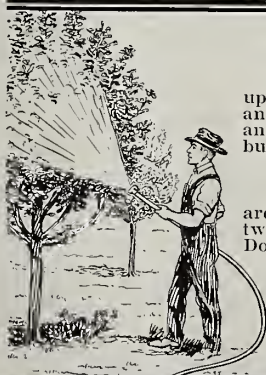
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limbs as well as the smaller branches and twigs of apple trees, and may remain in position several years after the insects have died. A good way to determine the presence of living insects with this or other scales is to press them against the bark with some small, hard instrument and note if any juices are squeezed out. The wet stain against the bark is quite easily seen. The oyster-shell scale passes the winter in the egg state, so the shells will be found filled with eggs rather than the bodies of the insects.

This scale insect is seldom abundant enough to require treatment, but when so give two applications of lime-sulphur solution as for the greedy scale, but be sure to give the trunk and large limbs a thorough drenching.

The Brown Apricot Scale.—This insect is found upon apples, pears and prunes and grows much larger than the species before mentioned. It is light to dark brown in color and the shell is not hard until the insect is full grown. During the fall and winter the live scales are quite small, but may be seen without the aid of a glass, although this instrument will render the work easier. Live insects may be determined by squeezing and noting the emission of juices. As soon as the sap starts in the spring the brown scale begins to grow rapidly and shortly there is no trouble in finding the insect without a glass. The growing stages of this scale excrete considerable honey dew on which the black-smut fungus thrives well, with resulting blackening of leaves and fruit.

Spray during the winter with six per cent distillate emulsion or mechanically-mixed distillate and lye. Fortunately in the Coast climates the brown apricot scale is seldom numerous enough to require treatment.

The Black Scale is similar in habits and general appearance to the brown apricot scale. Under Coast conditions it occurs principally on apricots, but may be at times upon other trees. Citrus trees are very subject to its attacks. This scale is distinguished from the foregoing species by the blacker color of the adult insect and the presence of ridges on the back resembling the letter H.

While the black scale may at times become numerous enough to smut the

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fruit this seldom occurs, and so treatment is rarely, if ever, necessary with deciduous trees. If trouble occurs frequently spray with distillate as for the brown apricot scale. The lime-sulphur solution is not effective against this or the brown apricot scale.

The Tussock Caterpillar (horned caterpillar).—The egg masses of this moth are to be found on all portions of the tree during the winter. These egg bunches are about the size of a pea, of light gray to brown color and somewhat fuzzy. Hatching commences in the early spring, even before the leaf buds open, and continues for several weeks. The young caterpillars eat the buds, foliage and also the small fruit. The apple is the most commonly attacked. The injury to the fruit results in a rough scar which may greatly mar the appearance of the apple.

When this caterpillar is giving trouble the egg masses should be thoroughly picked off during the winter, as this is at present the most practical means of control. Success depends upon the thoroughness of the work, and it is often necessary to go over the trees two or three times to get satisfactory results. Sometimes almost no eggs will be found even when the caterpillars were abundant the preceding spring. Such a condition indicates that natural enemies have reduced the pest to a point where it will not prove troublesome.

The Peach Worm is the larva of a small moth. This insect winters over in the larval stage in shallow burrows made in the bark of the twigs and small branches. About the time that first blossoms appear the worms open up their burrows and begin to search for food. At this time the expanding leaf buds are attacked and frequently killed. Young shoots two or three inches in length will frequently be seen to wither up and die, a worm will be found to have burrowed in at the base. These wintering-over worms soon come to maturity and transform into moths which give rise to a second generation about the middle of May. The second generation worms make numerous small burrows in the twigs and finally enter the fruit, thus causing the greatest damage.

The worms remove the covering of their burrows when the blossom buds are expanding, and so may be reached at this time by a contact spray. The lime-sulphur solution has been found to be very effective when used just as the first blossoms are opening or slightly earlier. Use full winter strength. The treatment does not endanger the fruit crop.

The Woolly Aphis.—This insect belongs to the plant-louse family and attacks apple trees only. It is found both on the roots and tops. This aphis winters over on the tops as well as the roots, and the top infestations come principally from colonies that have lived over above the ground. The top form is not found generally distributed

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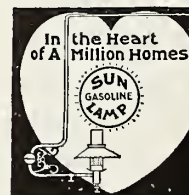
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over the tree during the winter, but is confined to small colonies sheltered by rough places in the bark. The woolly aphid is large enough to be readily seen and develops in compact colonies which during the summer may be very numerous and distributed over many of the small branches. The most characteristic feature of this species is the production of a white substance in fine filaments which adheres to the body, forming a wool-like protection. The injury caused by the aphid consists of a drain on the sap and the injection of a toxic substance which causes swellings to appear on the attacked portions, especially the roots. Also when the top form is abundant the excretion of a gummy honey dew mars the appearance of fruit and tree. Under certain soil conditions the woolly aphid may seriously damage the roots, stunting and sometimes killing the tree. In the Pajaro Valley, however, the root form is seldom the cause of serious injury, and often is not present at all.

We have demonstrated that the thorough disinfection of the tops during the winter will greatly check the aphid the following season. The distillate emulsion spray referred to under the greedy scale will do the work, but such thoroughness is required that it is doubtful if the average grower can successfully apply the method. It is necessary to wet all the colonies hidden in cracks and crevices in the bark, and in our experiments twenty gallons of spray was used per tree. When the root crown is infested remove the earth until the first roots are exposed and then pour in several gallons of a strong tobacco decoction. In general the best results with the woolly aphid are to be obtained by spraying during the spring and summer with tobacco decoction or a nicotine spray.

The Green Aphis is an apple pest and attacks young or rapidly-growing trees most frequently. This plant louse is on the trees in the egg state during the winter. These eggs are laid by the last generation of lice during the late fall and early winter months and may be found on the young twigs, especially those that have grown late in the season. The eggs are small, shiny-black bodies, pointed oval and about twice as long as broad, and are laid lengthwise against the twig. Green aphis eggs are large enough to be seen without the aid of a glass, but more readily with one. Where the eggs are abundant there is a distinct musty odor given off, especially when crushed by drawing the twig through the fingers. The green aphis eggs hatch in the spring. All the individuals are females and quickly mature, giving birth to numbers of living young. Some of the lice develop wings, thus enabling them to spread rapidly. This aphis attacks the young growing shoots, preferring the stem portion rather than the leaves, but the foliage may also be infested. The attacked leaves are somewhat curled, but not so markedly as with the leaf-curling aphis (another species). The lice are bright green in color, but some

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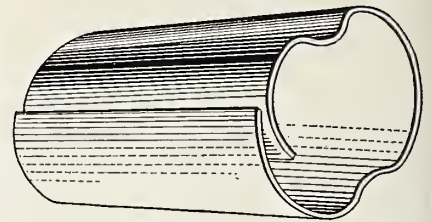
individuals may be of darker shades. They, like other aphids, suck the juices by the insertion of a sharp beak, and do not eat the surface tissues. Considerable honey dew is excreted and affords a good medium for the growth of the black-smut fungus. Badly attacked trees are often quite black before fall, and on this account the species is sometimes called the "black aphid." The injury to the tree consists in the dwarfing of the young growth by the excessive drain on the sap, and probably also by the injection of a toxic substance; also the excessive growth of black-smut fungus which may appear on the honey-dew excretions.

Under certain conditions the application of lime-sulphur solution, when the leaf buds are bursting, will effect partial and perhaps complete control. The eggs are not killed by the spray, but if dry, warm weather prevails during the time of hatching the young lice are injured by the sulphur vapors given off by the spray deposits. The weather conditions required for the proper action of the lime-sulphur solution may not be met in the Coast localities, so the application of this spray frequently gives poor results. It may then be necessary to rely on spring and summer treatment with tobacco decoction as for the woolly aphid.

The Leaf-Curling Aphid.—This aphid also attacks apples, but its presence on the trees during the winter has not been demonstrated. The species is believed to pass the winter on other vegetation. The leaf-curling aphid is mentioned here because it is frequently mistaken for the green aphid. It is a spring and early summer form, not being present after the month of June. The leaves are very badly curled by this species, which seldom attacks the stems, but remains on the under sides of the leaves. The fruit on the branches attacked sets very profusely, but is stunted and rendered worthless. The injury is due to the injection of a toxic substance into the plant tissue.

No winter treatment is known to be effective, and the only recourse is the use of tobacco or nicotine sprays during the spring and early summer.

Red Spider (mites).—Deciduous fruit trees are subject to the attacks of at least three species of mites, but this class of pests are seldom serious in the Coast districts. In the interior valleys, however, almonds, prunes and peaches may be badly damaged. Mites are present on the trees during the winter in the egg stage. In the case of the almond red spider (Bryobia) the bright red eggs may be so numerous as to make distinct patches of color on the branches and even the trunks of the trees. Where less numerous the eggs will be found mostly on the small twigs. The eggs are quite round, but rather too small to be seen individually without the aid of a glass. The eggs hatch in the early spring and there are several generations during the summer. The mites suck the juices from both surfaces of the leaves and cause the foliage to become brown or gray col-



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ored. Bad attacks cause the falling of the foliage and stunting of the fruit.

The winter eggs may be killed by using strong distillate emulsion as for the greedy scale, but this treatment has seldom been used. Lime-sulphur solution applied just as the buds are opening should control the red spider under the same conditions as it is effective against the green aphid. In general the simplest treatment for red spiders is sulphur applied during the spring and early summer, either as a dust or suspended in water as a liquid spray. The wet application is most effective.

The Scab is a fungous disease of apples and pears. The fungus is present on the trees during the winter, but cannot be discovered by ordinary means of observation. In the spring and summer it develops on the foliage and fruit, producing brown, sooty spots. The blossoms may also be attacked and killed before the fruit can set. Fruit attacked by the scab is often much deformed and marred in appearance as well as quality. The scab is dependent on frequent rains during the spring for its development. The apple scab is very subject to weather conditions, and so is not a regular visitor to the California orchards. The pear scab is more hardy, however, and may be expected to some extent every year.

Winter spraying with the lime-sulphur solution greatly checks the scab, especially on pears. The treatment is most effective when applied just as the leaf buds are opening. Use full winter strength and spray as for San Jose scale. One treatment can be made to answer for both complaints. Winter spraying greatly aids in scab control and may be sufficient, but when weather conditions are especially favorable to the development of the disease should be supplemented by spring applications of the bordeaux mixture.

The vegetable growth on the bark of trees commonly called "moss" is well known to practically everyone. This growth is not a true moss, but comprises several species of lichens. These lichens consist of a combination of two plants, a fungus and an alga. The fungus is dependent upon the alga, but the latter plant may be grown alone. Lichens are not dependent upon the body on which they grow, but derive their nourishment from the air. Growth takes place only during rains or when the air is saturated with moisture, hence moss is very seldom seen on trees in dry climates. Lichen growths are sometimes very abundant on trees in the Coast climates, but so far no direct injury has been traced to them. Some claim that a hide-bound condition is produced, and it is probable that insect and fungous diseases may be harbored by the lichens. The Italian pear scale is a case in point. In general moss is more an indicator of neglect than a direct injury to the tree.

The lime-sulphur solution, bordeaux mixture and distillate with lye as used in regular spraying will all kill moss, so special treatment is unnecessary where applications for other troubles

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are made. A dilute lye solution is probably the simplest remedy for moss where it is not necessary to treat for other diseases. Use six pounds of soda lye to one hundred gallons of water.

The Peach-Leaf Curl.—This fungous disease is confined to the peach, some varieties being much more troubled than others. There is no evidence of the disease on the trees in the winter, but it appears shortly after the development of the leaves in the spring. The young foliage becomes distorted and thickened, losing the normal green color and varying from pale-yellow greens to gray and even pinkish shades. The diseased leaves soon fall, and where the attack is bad the young fruit also. The peach-leaf curl, like many other fungous diseases, is dependent upon wet weather for its best development and will not appear in dangerous amounts when there are no rains after the buds open.

The bordeaux mixture or lime-sulphur solution applied during the winter will control the leaf curl. The best results are obtained when the application is made just as the buds are swelling. The lime-sulphur wash as applied for the peach worm is also effective. When no winter treatment has been made the disease can be checked by an application of bordeaux after the foliage has developed somewhat. The application usually causes the falling of most of the leaves present at the time of spraying.

The Peach Blight.—This fungous disease causes the death of small twigs and is often accompanied by the exudation of gum from the diseased tissue. In bad cases all the early growth may be killed, including the blossom buds. The disease is not easily discovered during the winter, but becomes evident as soon as the young growth starts. This fungus is also dependent upon wet weather in the spring for destructive development. Up to the present time the peach blight has done very little damage in the Coast districts, but is much more serious in the interior valleys.

The spores of this parasite are germinated by the first winter rains and the fungus soon penetrates the bark of the small twigs, where it is comparatively immune to spray applications. On the other hand, if the trees are sprayed before the rains the spores will be prevented from germinating. Spray with the bordeaux mixture in the fall or early winter, not later than December 15. The lime-sulphur solution has also proved of value in the control of the blight, but is not considered so effective as the bordeaux mixture.

The Pear Blight is a bacterial disease of the pear, but also attacks apples. It has not proved serious in the Coast climates, but has been very destructive in the interior valleys. This disease attacks the inner bark or growing portion of the wood, gaining entrance in various ways, such as through the blossoms, tender growing shoots and injuries. The blight kills the tissues

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attacked and often is accompanied by the exudation of gum from the diseased portions. The dead twigs, suckers and limbs are readily seen during the winter, but the parts not yet killed and in which the blight is alive are often not so easily discovered. A little experience is necessary to enable one to locate such portions with certainty and thoroughness.

The treatment of this disease consists in the removal of all the infected portions during the winter. The cuts should be disinfected by washing with some germicide such as the bichloride of mercury solution (1 part in 1,000). If careful attention is paid to details this method has proved capable of dealing with the worst cases of blight. When an inexperienced grower has to deal with a serious case of blight it would be advisable for him to get instructions direct from some expert. No spraying treatment or injection or application of chemicals about the roots has as yet proved of any value in the control of the blight. On the other hand, weather conditions have a marked effect upon the disease, and the two dry springs last past have caused the almost complete disappearance of the blight from the Sacramento Valley pear orchards.

The Sappy Bark Disease.—The cause of this trouble has not yet been determined, but it is supposed to be parasitic. It attacks apple trees in localities which have a wet winter climate of moderate temperature. In the Pajaro Valley the Bellflower variety is most troubled. This disease appears always to start from cuts or injuries and spreads through the bark at first, producing a puffy condition. Later the diseased portion becomes watery, or even slimy, which suggests the name. The puffy condition is due to the degeneration of the inner bark and the production of a great number of much enlarged cells resembling the pus cells of animals. The diseased bark dies and wood is attacked by a rot fungus which continues indefinitely, and combined with renewed attacks of the bark disease eventually kills the limb or even the tree. The sappy bark disease is active during the entire winter, but most destructive when the sap begins flowing in the early spring. The disease flourishes best when rain is abundant and frequent, and almost entirely ceases during the dry season.

The sappy bark disease is a serious trouble, as it threatens the life of the tree, but as yet there is no positive remedy known. About the best that can be done is to prolong the life of the tree by cutting off the diseased portions and so postponing the time when the wood rot will finally enter and destroy the trunk. To get the best results from the cutting out treatment the orchard should be worked over several times during the winter and all the diseased bark removed. Badly infected limbs should be cut off down to the first good branch, but avoid cutting large limbs as long as possible. We have previously recommended the dis-

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infection of the cuts the same as for pear blight, but the results of several seasons does not indicate that much is gained by so doing. Painting over the cuts is also of doubtful value, as the paint covering retains moisture and so increases the danger of wood rot. Do not remove large limbs from healthy trees unless absolutely necessary, as the disease is almost certain to start in these large cuts.

The Apple Powdery Mildew is a fungous disease of the apple which is doing considerable damage in the Pajaro Valley and several other districts of the Pacific Coast. It is in a dormant condition during the winter, living over on the infected twigs of the last season's growth. These mildewed tips are of a gray color and quite easily seen, especially when the sunlight strikes them at the proper angle.

None of the winter sprays have proved of any value against the mildew, and at present the orchardist must rely upon spring and summer application to control the disease. In the case of a young isolated orchard it might be possible to accomplish something by the thorough removal of mildewed tips.

Pruning fruit trees is a quite general practice and is resorted to for several reasons. It is necessary to shape the tree and also to remove branches which interfere with cultivation. Suckers and brushy growths must also be removed to admit light more freely and so make possible the best development of the fruit. Dead wood should also be cut out, as it harbors dangerous fungous diseases. Unfortunately pruning may be attended by dangers quite as serious as those it is intended to counteract. The removal of large limbs is frequently followed by the attack of wood rots, especially in the humid Coast regions. The sappy bark disease of the apple almost invariably has its beginning in some old cut made by the pruner. The tree makes an effort to cover these cuts, but is seldom able to do so unless the exposed surface is comparatively small. For this reason the removal of large limbs should be avoided as far as possible and all pruning confined to branches less than two inches in diameter. Painting the stubs has long been considered a good practice, but it often works injury rather than good. The paint retains moisture in the stub and so frequently facilitates rather than retards wood rot. Under these circumstances we have no definite recommendations to make with regard to the painting of cut surfaces. It appears to be best to let the small cut go without treatment. The stubs of large limbs should be allowed to get thoroughly dry before painting. These cuts are usually made in the winter, and so can hardly be ready for painting before the following June. Use a quick-drying paint, as the oil from the slow-drying paints may penetrate and injure the living bark about the cut. In dry climates cuts usually heal over well because there is not sufficient moisture for the development of wood rots.

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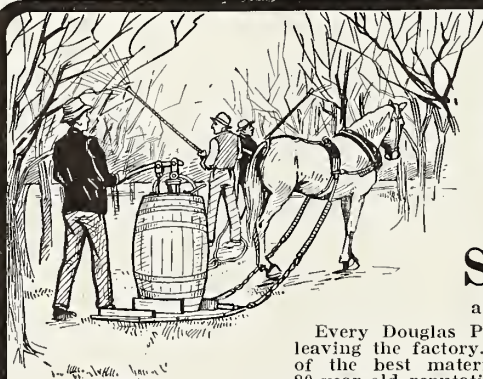
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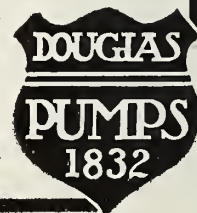
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Cranberry Culture on the Pacific Coast

Continued from last issue

In constructing a cranberry bog it is essential that care be exercised in sanding it. The sand should be kept clean and free from weeds or other organic matter, as the cleaner the sand the less trouble with weeds or other vegetation. The sand should be put on to a uniform depth of not less than three inches. Some authorities advise putting the sand on thicker on deep peat than on shallow peat. There are several methods used in sanding a bog. In some localities where the winters are severe the sand is hauled onto the bog with sleds and spread over the ice on the bog, and when the ice melts the sand settles uniformly over the bog. Where the sand is located close to the bog it is very often put on with wheelbarrows, and very often small cars are used with a portable track. The sand can also be hauled on with sleds by using horses or an engine on the solid ground. Another method used, and probably the cheapest where the conditions are favorable, is to pump the sand on in the proportion of about fifteen per cent sand and eighty-five per cent water. The sand and water is distributed over the bog by means of wood pipes. There is some question whether the sand can be put on as clean by pumping as by putting it on dry.

Cranberry bogs are established by planting cuttings from old vines. These cuttings should be from eight to ten inches long and are planted by forcing the middle of the vine through the sand into the peat. They are planted at various distances apart, the closer they are planted the sooner the bog is covered and crops secured. There should be at least two cuttings planted at each place. The object is to have the ground matted over with vines as soon as possible. After the vines are planted the bog should be flooded if possible in order to compact the sand around the vines. In the Eastern States the vines are mostly planted in the spring, in April or May; however, on this Coast there is no apparent reason why they cannot be planted in the fall and then get the advantage of the early spring growth. There are a great many varieties of berries, but the grower need not consider over a dozen varieties. In selecting the vines care should be exercised as to whether they are early or late, their keeping qualities, color, size and yield. The large, well-colored berries sell better than the smaller berries and bring better prices. At

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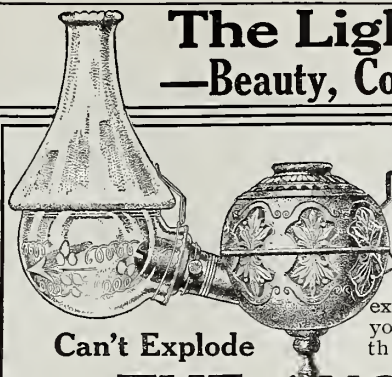
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present the plantings on this Coast are mostly all imported from the East, principally Massachusetts, although some vines have been secured in Wisconsin. The principal Massachusetts varieties are Early Black, Howe, Centennial, McFarlin, Bugle, Matthews, Pointed Howes and one or two more. Some of the Wisconsin varieties are Prolific, Searles Jumbo, McFarlin, Bennett Jumbo, Metallic Bell, Palmeto, Howe, Bell and Cherry, Bell and Bugle and Early Black. On this Coast there are more McFarlins and Early Blacks than any other variety. The Searles Jumbo are the only varieties secured from Wisconsin. On this Coast about 700 pounds of vines are planted to the acre. They are mostly planted about ten inches apart. The vines for planting are sold either by the ton or barrel and will cost from \$100 to \$300 a ton delivered on this Coast. Care must be taken in shipping the vines so that they are neither frozen or overheated.

Outside of dwelling houses for the employees there are not many buildings required in connection with cranberry culture. A packing and storehouse and some small tool houses are practically all that are needed. In some localities the storehouse is a very important item to be considered, as it is necessary to have it arranged in such a manner that the berries can be kept at a uniform temperature and dry. The storehouse should also be arranged that the sunlight can be kept from the berries. In some locations it will be necessary to provide shelter of some kind for the harvesters.

The equipment ordinarily needed is not very extensive, although it will generally be found that it will be economical to use some machinery in constructing the bog. It will mostly be found that the use of the machinery will pay for itself. The machinery need for the construction will consist of some mechanical means of scalping and removing the scalplings, some method of sanding the bog, and if there are any large ditches probably a small dredge. Unless the water supply can be secured by gravity some pumping plant will also be necessary. For the operation of the bog a spraying outfit, a sorting and grading machine, some method of hauling the berries from the bog to the packing and storehouse, some packing equipment and instruments needed for weather records and observations. The machinery and equipment for constructing bogs in different localities will necessarily be different, as the conditions are different. It may also be necessary in some places to have a large donkey engine for clearing the land. There will also be some small tools needed in growing and harvesting the crops.

After the bog is planted it will be at least three years before there is a paying crop. There will be a few berries each year. Under favorable conditions the crop the third year will more than pay for the production. The fourth year there should be nearly a full crop. There should be a full crop the fifth

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year. These crops will depend on the care given the bog during the developing period. By the use of fertilizers the growth of the vines can be greatly increased. The principal work required in caring for a bog during the developing period is to keep it free from weeds and to control the irrigation and drainage. The ditches and dams will also have to be kept clean. If a bog has been properly constructed this expense should be very slight if looked after in the proper manner. The proper height at which to keep the water in the ditches will depend on the conditions of each bog. During this period better results will be secured if the water is kept low, thus forcing the vines to root deeper and making them more hardy. While it is impossible to grow any other crops on a bog during the development period a part of the land can be planted in cranberries and the rest used for other purposes until the cranberries are producing. The entire bog can then be planted to cranberries. There are several crops which can be grown on this character of land.

There is probably no fruit crop which requires less work and attention during the growing season than cranberries. To get the best results it is necessary that they be properly attended and watched, but this does not require any great amount of laborious work. There are no horses required and there are several months of the year when there will be practically no attention at all required. There is no cultivation required in producing a crop of cranberries. There will be a little weeding, which can be done very cheaply by boys and girls, but if the bogs have been carefully constructed this will not amount to much. The ditches and dams will have to be kept free from weeds. The water and drainage will have to be carefully looked after. After a bog is in full bearing there is not much chance for the weeds to get started if they are looked after properly.

It will very often be necessary to flood the bogs to protect them from frost. This will occur both in the spring, when the plants are blooming, and also in the fall to protect the fruit. In some localities it is necessary to flood occasionally through the summer. The amount of water required will depend on the extent of the frost; in

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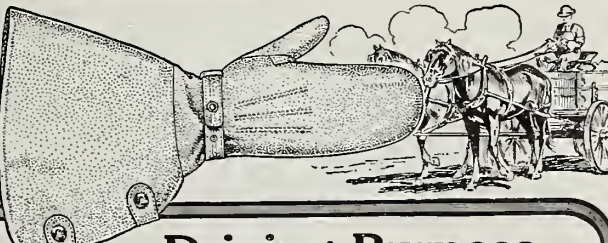
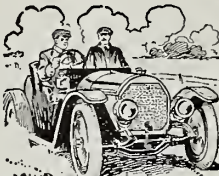
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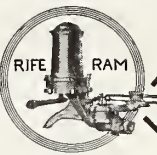
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some cases it will only be necessary to fill the ditches and in others an inch or so of water will be required. On this Coast it is not likely that it will ever require over an inch of water on the surface. It will be necessary that this water be put on within five or six hours and drained off in a couple of hours. Flooding is also used for fighting certain insects and diseases. The principal insects can be controlled by water. It is necessary that the bogs be irrigated and that the water be kept at a uniform depth below the surface in order that the vines may get the proper amount of moisture. Care must be exercised to see that the bog is not too wet or too dry, as either is injurious to the fruit. The character and quantity of the fruit produced depends greatly on the control of the water. The proper height at which to keep the water will probably range from twelve to thirty inches, depending on the character of the bog and the depth of the peat. Experiments have shown that it will be beneficial to re-sand the bogs every three or four years by putting a thin layer of sand of not over a quarter of an inch. The frequency and amount will depend on each individual bog.

The insects and plant diseases can be controlled either by spraying or flooding, or both. Studies have been made regarding the insects and diseases of the cranberry, and methods have been worked to combat them. Care should be taken to keep the ditches and dams clean from weeds, and if possible the surrounding fields should be kept clean. This can be done by mowing and spraying. Frost probably causes more damage than any other hindrance, but with a sufficient and available water supply there should be no loss from frost. There is also liable to be some damage from hail and wind, but there is practically nothing a grower can do to protect his bogs from them, except to start his bogs in a country not affected by them. Each year after the crop has been harvested the vines should be pruned. This keeps the bog in better shape for scooping and also makes the vines fruit better. It is possible to use the prunings for establishing new bogs.

Harvesting generally starts during August and continues through September, and sometimes into October, depending on the locality. The harvesting season generally lasts from three to four weeks. The berries are generally picked before they are fully ripe and are allowed to ripen and color in storage. They are harvested either by hand picking or by scooping. The young vines should be hand picked and the older vines scooped. There are not as many berries lost by scooping as by hand picking. Harvesting is generally paid for by the bushel and is by far the greatest expense connected with the production. Cranberry harvesting is an industry that practically entire families can work at and earn good wages. After the berries are harvested they are taken to the packing and store-

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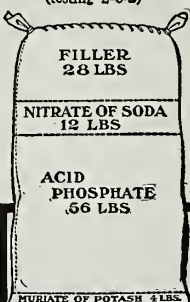
Clears 1 to 5 Acres a Day **Pulls Stumps Seven Feet Thick**

house, where they are cleaned, sorted, graded and packed in boxes or barrels. They are then stored until time for shipment. The storehouse should be kept at a uniform temperature at some point between 40 and 60 degrees. While in storage the berries should be kept so that they are well ventilated, and also be kept away from the sunlight.

The best results are secured in marketing when the growers form an association for handling the fruit. In this way a uniform standard grade of product can be secured. A better distribution of the product can also be secured, and also better prices. The product can also be handled more economically than where each individual cares for his product. A great part of the fruit can be used for canning and evaporating and disposed of in markets not convenient for fresh fruit. Cranberries are packed for shipment mostly in barrels containing three bushels, and also to a small extent in one bushel boxes. Probably on this Coast the boxes will make the better packages. Nearly all the berries now grown are sold and distributed by one selling agency. They watch the distribution very closely and keep track of the expected crops each year and regulate the prices accordingly.

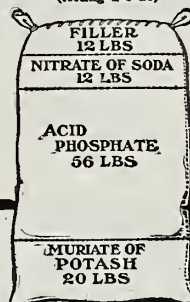
The cost of constructing a bog will depend very greatly on the location, character of clearing, methods used and equipment used, accessibility of sand and water, size of bogs, varieties of vines and many other conditions. Where the work has been done by hand in small tracts, and especially where the land is covered with large trees the cost very often is very high. There have not been enough bogs planted on this Coast to secure accurate estimates of preparing and planting the land, and consequently all estimates must be based on the cost of what bogs have been constructed and the cost in other localities modified to suit local conditions. The cost of preparing and planting bogs on this Coast will probably range from \$200 to \$500 an acre, depending on the size of the bogs, the methods used, location, vines and other conditions. Practically the only expense during the development period will be to keep the bogs free from weeds and the ditches and dykes clean. The expense for caring for a

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Talk to your dealer and ask him to carry Potash in stock or order it for you. It will pay you both, for

Potash Pays

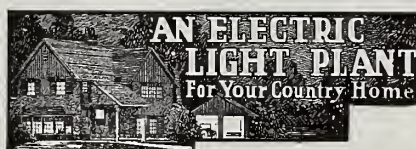
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WHEN WRITING ADVERTISERS MENTION BETTER FRUIT

bog during this time will probably be in the neighborhood of twenty-five dollars an acre per year, depending on the size of the bogs and other conditions. The crop secured the third year should pay the expenses of maintaining the bog until that time. It is estimated that the cost of production in Wisconsin is about \$2.50 per barrel. A large cranberry company in Massachusetts estimates their cost of production at \$1.50 per barrel. It is probable that the cost on this Coast will be about \$2.50 per barrel.

Considering the amount of work and security of the investment, where the conditions are right, there is probably no line of fruit culture which will be as safe and profitable as cranberry culture. As in any other industry, the returns will depend on the management and other conditions. There will, of course, be some bogs which will pay very small returns and others will only be average. The bogs from which the best returns will be received will be those which have the proper natural conditions and where they are properly managed. In all cases where bogs are not paying properly the cause can always be traced to lack of natural conditions or improper management. There are instances on record where small bogs have netted the owners in the neighborhood of \$1,000 an acre. There is a five-acre bog on this Coast that for a number of years has netted about \$500 an acre. In New England there is a bog that for seventeen years has averaged over 100 barrels an acre. In Wisconsin a bog averaged over 125 barrels for three years. There are records of bogs yielding 250 barrels per acre. Bogs on this Coast have produced 200 barrels per acre. These yields are on bogs where the conditions are favorable. A bulletin published by the Wisconsin Experiment Station gives the average production of several clean-culture bogs as 97 barrels per acre and the net returns close to \$500 an acre. As the selling price of cranberries on this Coast is two dollars a barrel higher than the Eastern price the returns should be considerable higher. With the proper conditions and proper management, and without these no one should attempt cranberry culture, the bogs on this Coast should produce 100 barrels per acre. The selling price of cranberries on this Coast ranges from eight to twelve dollars per barrel. The average price has probably been between nine

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and ten dollars a barrel. Assuming the cost of production at \$2.50 per barrel a net return of from five to six dollars a barrel will be conservative. One should expect to net from \$300 to \$500 an acre at least from good bogs on this Coast. In addition to the large annual returns from the bog is to be considered the increased value of the investment. A good producing bog is worth not less than \$2,500 an acre.

Any person intending to engage in cranberry culture should be very careful in selecting the location. There is very little land where all the essential natural conditions are present, and the amount of money required to establish a bog is too large to invest in places where success is not assured. A thorough investigation should be made before deciding on any location. It will generally be found that the best land is held at a high price, but if the natural conditions are right there should be no hesitancy in paying it, as the returns will fully justify the investment. In constructing the bog the best methods should be used and the work well done. Care should be used in selecting the variety of vines to be planted. Convenience to cities and transportation facilities should be thoroughly considered in selecting a location, as they will have a great influence on the construction and operation of the bog. It is desirable that the bog be located in the vicinity of other bogs, the larger the acreage in the vicinity the better.

The Short Course of the Oregon Agricultural College, Corvallis, Oregon, will be held from January 6 to February 7. During the winter months, when fruit growers have spare time, this is a splendid opportunity to attend these short courses and receive scientific instruction in the different branches pertaining to fruit growing.

The Massachusetts Agricultural College, Amherst, Massachusetts, will hold a ten weeks' course, beginning January 6th. The course will consist of five exercises a week, with lectures, demonstration, and whenever possible actual work by the student.

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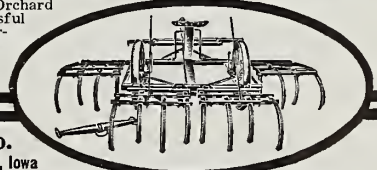


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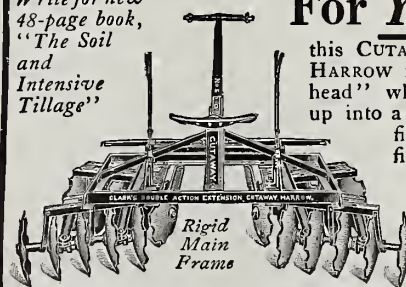
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Northwest Fruit Growers' Unions and Associations

We publish free in this column the name of any fruit growers' organization. Secretaries are requested to furnish particulars for publication.

Oregon

Albany Fruit Growers' Union, Albany.
Ashland Fruit and Produce Association, Ashland.
Benton County Fruit Growers' Association, Corvallis.
Brownsville Fruit and Produce Association, Brownsville.
Coos Bay Fruit Growers' Association, Marshfield.
Coquille Valley Fruit Growers' Union, Myrtle Point.
Cove Fruit Growers' Association, Cove.
Dallas Fruit Growers' Association, Dallas.
Douglas County Fruit Growers' Association, Roseburg.
Dufur Valley Fruit Growers' Union, Dufur.
Dundee Fruit Growers' Association, Dundee.
Estacada Fruit Growers' Association, Estacada.
Eugene Fruit Growers' Association, Eugene.
Hood River Apple Growers' Union, Hood River.
Hyland Fruit Growers of Yamhill County, Sheridan.
Imbler Fruit Growers' Union, Imbler.
La Grande Fruit Association, La Grande.
Lincoln County Fruit Growers' Union, Toledo.
McMinnville Fruit Growers' Association, McMinnville.
Mil'ron Fruit Growers' Union, Milton.
Mosier Fruit Growers' Association, Mosier.
Mount Hood Fruit Growers' Association, Sandy.
Newburg Apple Growers' Association, Newburg.
Northwestern Fruit Exchange, 418 Spalding Building, Portland.

Northeast Gaston Farmers' Association, Forest Grove.
Oregon City Fruit and Produce Association, Oregon City.
Rogue River Fruit and Produce Association, Medford.
Salem Fruit Union, Salem.
Santiam Fruit Growers' Association, Lebanon.
Springbrook Fruit Growers' Union, Springbrook.
Stanfield Fruit Growers' Association, Stanfield.
Sutherlin Fruit Growers' Association, Sutherlin.
The Dalles Fruit Growers' Union, The Dalles.
Unquava Valley Fruit Growers' Association, Roseburg.
Washington County Fruit Growers' Association, Hillsboro.
Willamette Valley Prune Association, Salem.

Washington

Apple Growers' Union of White Salmon, Underwood.
Bay Island Fruit Growers' Association, Tacoma.
Brewster Fruit Growers' Union, Brewster.
Buckley Fruit Growers' Association, Buckley.
Cashmere Fruit Growers' Union, Cashmere.
Clarkston Fruit Growers' Association, Clarkston.
Cowlitz Fruit and Produce Association, Kelso.
Dryden Fruit Growers' Union, Dryden.
Elma Fruit and Produce Association, Elma.
Felida Prune Growers' Association, Vancouver.
Garfield Fruit Growers' Union, Garfield.
Goldendale Fruit and Produce Association, Goldendale.
Grandview Fruit Growers' Association, Grandview.
Granger Fruit Growers' Association, Granger.
Kalama Fruit Growers' Association, Kalama.
Kennewick Fruit Growers' Association, Kennewick.
Kiona Fruit Growers' Union, Kiona.
Lake Chelan Fruit Growers' Association, Chelan.
Lewis County Fruit Growers' Association, Centralia.
Lewis River Fruit Growers' Union, Woodland.
Mason County Fruit Growers' Association, Shelton.
Mount Vernon Fruit Growers' Association, Mount Vernon.
Northwestern Fruit Exchange, 510 Chamber of Commerce Building, Spokane.
Peshastin Fruit Growers' Association, Peshastin.
Pullman Fruit Growers' Association, Pullman.
Puyallup and Sumner Fruit Growers' Association, Puyallup.
Spokane County Horticultural Society, Spokane.
Spokane District Fruit Growers' Association, Spokane.
Spokane Inland Fruit Growers' Association, Kelising.
Spokane Valley Fruit Growers' Co., Otis Orchards.
Spokane Valley Fruit Growers' Union, Spokane.
Southwest Washington Fruit Growers' Association, Chelan.
Stevens County Fruit Growers' Union, Myers Falls.
The Green Bluffs Fruit Growers' Association, Mead.

A PANORAMIC VIEW

of the
Famous Hood River Valley
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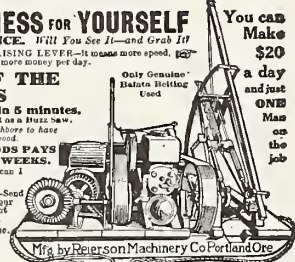
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The Ridgefield Fruit Growers' Association, Ridgefield.
The Touchet Valley Fruit and Produce Union, Dayton.
Thurston County Fruit Growers' Union, Tumwater.
Vashon Fruit Union, Vashon.
Walla Walla Fruit and Vegetable Union, Walla Walla.

Wenatchee District Fruit Growers' Union, Wenatchee.
Wenatchee Valley Fruit Growers' Association, Wenatchee.
White River Valley Fruit and Berry Growers' Association, White Salmon.
Yakima Valley Fruit Growers' Association, North Yakima.
Yakima Valley Fruit and Produce Growers' Association, Granger.

Yakima County Horticultural Union, North Yakima.
Zillah Fruit Growers' Association, Toppenish.

Idaho

Boise Valley Fruit Growers' Association, Boise.
Caldwell Fruit Growers' Association, Caldwell.
Council Valley Fruit Growers' Association, Council.
Emmett Fruit Growers' Association, Emmett.
Fruit Growers' Association, Moscow.
Lewiston Orchards Assembly, Lewiston.
Lewiston Orchards Association, Lewiston.
Nampa Fruit Growers' Association, Nampa.
New Plymouth Fruit Growers' Association, New Plymouth.

Parma-Roswell Fruit Growers' Association, Parma.
Payette Valley Apple Growers' Union, Payette.
Southern Idaho Fruit Shippers' Association, Boise.
Twin Falls Fruit Growers' Association, Twin Falls.
Weiser Fruit and Produce Growers' Association, Weiser.
Weiser River Fruit Growers' Association, Weiser.

Colorado

Boulder County Fruit Growers' Association, Boulder.
Capital Hill Melon Growers' Association, Rocky Ford.
Crawford Fruit Growers' Association, Crawford.
Delta County Fruit Growers' Association, Delta.
Denver Fruit and Vegetable Association, Denver.
Fair Mount Melon Growers' Association, Swink.
Fowler Melon Growers' Association, Fowler.
Fronton County Fruit Growers' Association, Canon City.
Granada Melon Growers' Association, Granada.
Grand Junction Fruit Growers' Association, Clifton, Palisade, Grand Junction.

Kouns Party Cantaloupe Growers' Association, Rocky Ford.

Lamar Melon Growers' Association, Lamar.
Longmont Produce Exchange, Longmont.
Loveland Fruit Growers' Association, Loveland.
Manzanola Fruit Association, Manzanola.
Manzanola Orchard Association, Manzanola.
Montrose Fruit and Produce Association, Montrose.
Newdale Melon Growers' Association, Swink.
Palisade Fruit Growers' Association, Palisade.
Paonia Fruit Exchange, Paonia.
Pent County Melon Growers' Association, Las Animas.
Produce Association, Debeque.
Rifle Fruit and Produce Association, Rifle.
Roaring Fork Potato Growers' Association, Carbondale.
Rocky Ford Melon Growers' Association, Rocky Ford.
San Juan Fruit and Produce Growers' Association, Durango.

The Producers' Association, Debeque.
Western Slope Fruit Growers' Association, Palisade.

Montana

Bitter Root Fruit Growers' Association, Hamilton.
Missoula Fruit and Produce Association, Missoula.
Woodside Fruit Growers' Association, Woodside.

Utah

Bear River Valley Fruit Growers' Assn, Bear River City.
Brigham City Fruit Growers' Association, Brigham City.
Cache Valley Fruit Growers' Association, Wellsville.
Centerville Fruit Growers' Association, Centerville.
Excelsior Fruit and Produce Association, Clearfield (post office Layton R. F. D.).
Farmers & Fruit Growers' Forwarding Assn, Centerville.
Green River Fruit Growers' Association, Green River.
Ogden Fruit Growers' Association, Ogden.
Springville Fruit Growers' Association, Springville.
Utah County Fruit and Produce Association, Provo.
Willard Fruit Growers' Association, Willard.

New Mexico

San Juan Fruit and Produce Association, Farmington.

California

California Farmers' Union, Fresno.
California Fruit Exchange, Sacramento.
Fresno Fruit Growers' Company, Fresno.
Lincoln Fruit Growers' Association, Lincoln.
Lodi Fruit Growers' Union, Lodi.
Loomis Fruit Growers' Association, Loomis.
Newcastle Fruit Growers' Association, Newcastle.
Penryn Fruit Growers' Association, Penryn.
Sebastopol Apple Growers' Union, Sebastopol.
Sebastopol Berry Growers' Union, Sebastopol.
Stanislaus Farmers' Union, Modesto.
The Supply Company of the California Fruit Growers' Association, Los Angeles.
Turlock Fruit Growers' Association, Turlock.
Vacaville Fruit Growers' Association, Vacaville.
Winters Fruit Growers' Association, Winters.

British Columbia

Armstrong Fruit Growers' Association, Armstrong.
Boswell Fruit Growers' Association, Boswell.
Brit. Columbia Fruit Growers' Association, Victoria.
Creston Fruit and Produce Exchange, Creston.
Grand Forks Fruit Growers' Association, Grand Forks.
Hammond Fruit Association, Ltd., Hammond.
Hatzic Fruit Growers' Association, Hatzic.
Kaslo Horticultural Association, Kaslo.
Kelowna Farmers' Exchange, Ltd., Kelowna.
Kootenay Fruit Growers' Union, Ltd., Nelson.
Mission Fruit Growers' Association, Mission.
Okanagan Fruit Union, Ltd., Vernon.
Queens Bay Fruit Growers' Association, Queens Bay.
Salmon Arm Farmers' Exchange, Salmon Arm.
Summerland Fruit Growers' Association, Summerland.
Victoria Fruit Growers' Exchange, Victoria.
Western Fruit Growers' Association, Mission.

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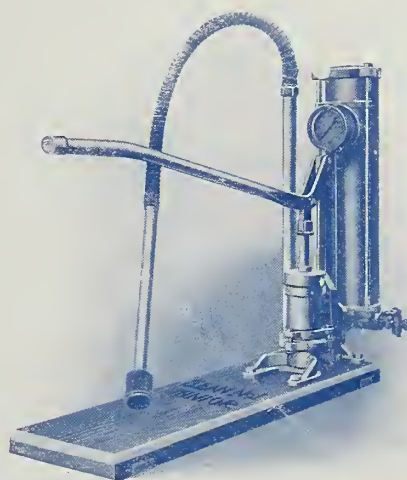
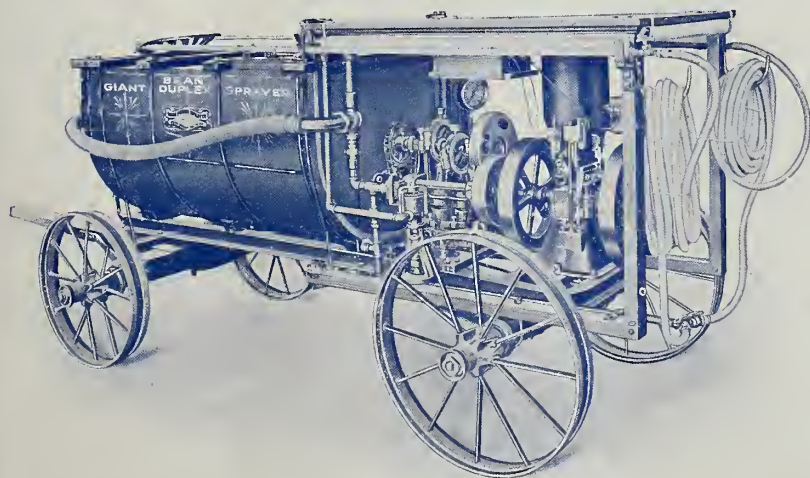
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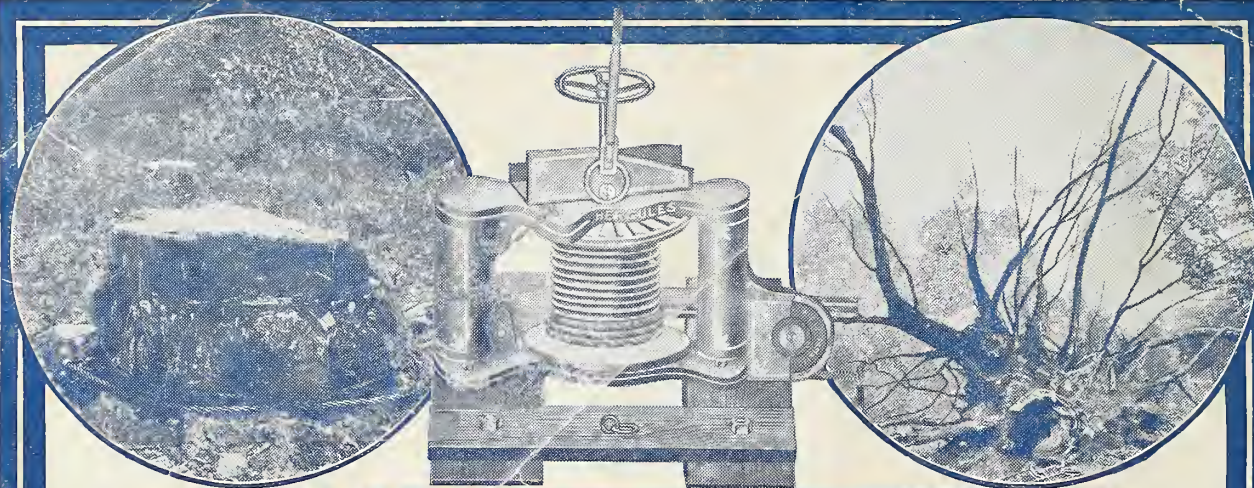
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